Real Cost of Ownership of Network Computer Devices

A Multiclient Study

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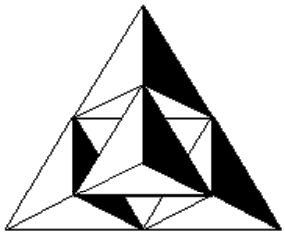


META Group Consulting

Interactive Computing and Commerce Strategies

Table of Contents

Table of Figures

List of Tables

Executive Summary

META Group's multiclient study on the real cost of ownership (RCO) of network computer devices represents primary research into determining the steady-state costs associated with all classes of these desktop systems. META Group conducted this study to understand a select group of companies' projected or real investments in — and costs associated with — network computer device hardware, software, networking, management, support, and training, compared to the cost of ownership of Windows-based PCs. META Group interviewed 52 companies — most from the Global 2000 — to obtain the data used in this analysis. The companies that supplied the data on network computer devices are leading-edge adopters of this technology. Whenever possible, META Group used real cost figures supplied by the survey participants. In some instances, we also used a collective set of data from previous RCO studies and other primary META Group research to augment the analysis.

For the purpose of this study META Group defines a network computer device as one within a broad class of computing devices that use various PC technologies to gain access to networked or Web-based environments. For the basis of this study, these are stateless machines that rely on servers to store all volatile data and software, except for information that may be temporarily cached in RAM or in some instances on disk. All applications and data that are stored on a server may be automatically refreshed for local processing at the desktop. Most network computer devices are diskless, and all can run network browsers locally. Depending on the particular vendor's network computer product and its targeted application, network computer devices may be equipped with a variety of technology components including RAM, modem, monitor, keyboard, and other additions. For this survey, the broad terminology "network computer device" will be used to describe all classes and brands of network computer devices.

Findings from the Survey Respondents

The real costs of ownership of network computer devices are inextricably woven with the benefits of multitier network computing. Network computing is a server-centric software architecture with clients that can be network computer devices, personal computers, terminals, workstations, and various other desktop devices. One of the most significant findings of this report is that the IT managers who participated in this study were not as concerned about the actual costs of their desktop devices as they were about being able to control the costs of supporting, operating, and managing their companies' desktop computers. Every IT manager in this study said that the lack of standardized desktop systems in their organizations caused their staff to expend significant amounts of time and money in an effort to maintain and administer dissimilar configurations of desktop devices. The participants believe the network computer device represents a way to control their escalating costs, while standardizing on one type of desktop computer that could be easily and cost-effectively deployed throughout their departments or, in some cases, their entire organizations.

The IT managers who participated in this study indicated that when desktop devices are processing all data and applications on the server, it does not make a significant difference,

from a cost-of-ownership perspective, which type of network computer device is being used. In addition, survey participants maintained that the variation in cost of ownership between different network computer device products and features is not statistically significant.

Network computing is attractive to the participant corporations for a wide variety of reasons. As multitier network computing becomes a fact of life in most Global 2000 companies, the need for a fully configured PC on every desk becomes less important — particularly with the use of fixed function, "heads down" applications where there is little or no requirement for local processing or data. For these types of applications or as replacements for dumb terminals, a thin or slim client device can be more cost-effective than a fully configured PC. And it is this evolution from the desktop to the server that is creating opportunities for network computer devices in key applications.

All participants of this study anticipated a major cost reduction in the support and maintenance of all their corporate desktop systems as a result of replacing outdated or under-powered PCs with network computer devices. In addition, they expected to reduce the cost of software support and distribution by moving to centralized administration and network computer devices.

To summarize the RCO findings, the respondents believe that network computer device environments will have the lowest capital and operational costs of any distributed computing environment, if they are operated efficiently and are targeted to run the appropriate networked applications. META Group calculates that the RCO for a pure network computer environment can be 23% less expensive than the combined hardware purchase, training, support, maintenance, and operational costs of the typical unmanaged PC LAN environment found in many Global 2000 companies. A well managed PC can provide a 15% savings over the costs of the typical unmanaged PC LAN environment. Moreover, the overall costs of a networked desktop device represents, on average, a 25% capital cost savings over the typical unmanaged PC LAN environment for the hardware alone. A well managed PC represents a 15% capital cost savings over the hardware costs over a typical unmanaged PC LAN environment.

The respondents of the survey indicated that they expect their steady-state application development and application support costs to remain approximately the same. In addition, they expect their desktop device support and maintenance to decrease.

Regardless of the brands being considered, all network computer devices have common characteristics. They are often only slightly less expensive to buy than a typical unmanaged PC, but they will save administrative, support, and maintenance costs over time. META Group calculates that the break/fix support costs for network computer device environments are actually 34% less than for typical unmanaged PCs. Costs can be lowered by having fewer moving parts, by storing all software and user configuration on the server, and locking down users. Consequently, when IT managers take active steps to limit end user flexibility, to increase standardization of desktop platforms, and to centrally manage PCs then savings similar to those of network computer devices are achievable.

Yet the primary differentiator of the capability of one type of network computer device from another is, and will continue to be, the application. The application will determine the RCO of the device as well. The RCO depends directly on how the desktop device is used and how much of the application is centrally managed or executed — not necessarily on the specific type of desktop device.

Network computer devices are not the only solution for achieving real cost savings on the desktop. While they are a natural replacement for dumb terminals, their use for running certain types of productivity and workgroup applications is constrained by their lack of local storage.

In summary, the actual cost of ownership of any desktop device will depend on the complexity of the environment and the success of the IT department in both standardizing the client platform and centralizing management and administration of desktop tasks.

The steady state RCO of the combined types of network computer devices in a distributed computing environment is summarized in the following table. META Group's internal calculations assume that pure network computer devices are either one of the following types of systems: host terminal replacements in which all applications execute on the server and only screen refresh information is sent to the client; or Java-based clients where some application logic is downloaded to the client as Java applets.

Cost Component	*Pure Network Computer Device Environment*
Capital Costs	
Client (with applications)	$592
Network	$234
Server	$237
Total Capital Costs	$1,063
Operational Costs	
Management	$678
Support	$387
Training	$48
Total Operational Costs	$1,113
Total RCO Costs	$2,176

META Group Bottom Line

Network computing represents a basic shift in how organizations think about and deliver new generations of Web-based and networked applications. Network computing offers IT departments a cost-effective way to control, manage, and operate desktop computing platforms in key server-centric application environments. META Group believes network computing represents both an overall architectural evolution and a software architecture which

encompasses network computer devices, PCs, terminals, and a variety of other networked systems. Moreover, network computing will be able to provide a lower cost of ownership than today's unmanaged PC environment.

Network computer devices will succeed in specific applications and industries, because these devices help IT control the cost of service and support for distributed desktop software. Network computer devices are one means of enabling IT organizations to centrally control and deliver applications and software upgrades more efficiently and cost-effectively. Network computer devices can provide a compelling alternative to the desktop PC in certain targeted applications or environments. But managed PCs can also provide a way to control costs for more variable, general purpose, end user and collaborative computing environments.

Since network computer devices are stateless clients, they can easily be shared by different users or shifts of employees. The devices also help to eliminate the problems caused by "unauthorized" software installations, which often wreak havoc on networks, servers, and desktop PCs. Both these activities can be implemented in a managed PC environment, but this will require active work on the part of the IT department. Network computer devices force the discipline automatically.

Companies are looking for ways to match user job function to the appropriate desktop system in order to control costs. It is not always necessary or cost-effective for companies to provide a full-function PC for every employee that might need to use a computer at the office. Although the purchase price of network computer devices may not be significantly lower than Windows-based PCs, these devices are easier and more cost-effective to support than standalone PCs for various reasons. The PC's complex array of features, operating system, and user interface options makes it more likely to be prone to problems due to user-generated mistakes, or to real hardware or software errors. Indeed, PCs must be configured individually, even if they are centrally managed. Consequently, PCs often require more technical support than dumb terminals or network computer devices. More tightly managing the PC configuration can minimize but not eliminate these issues. Although network computer devices are not immune from some configuration and software interaction errors, these devices do force greater consistency and centralization to minimize the problems.

META Group believes there will be three phases in the evolution and adoption of network computer devices: Evaluation and Pilot Phase(1997-1999), Early Adoption and Deployment Phase, (1998-1999) and Integration and Growth Phase (2000-2001).

Evaluation and Pilot Phase -- Companies are pilot testing these products in their organizations. In many cases, more than one vendor's product and/or different classes of device is being tested. Companies we surveyed plan to take from six months to two years to deploy these devices throughout their organizations. We believe this will be representative of a general trend throughout most Global 2000 companies planning a migration to network computer devices.

- **Early Adoption and Deployment Phase** -- Through 1999, the bleeding- and leading-edge companies will begin to deploy network computers in various application areas in their companies. We expect companies to begin using and deploying different classes of

network computer devices as existing applications are ported to servers and as new server-based applications are developed. These systems will then move from bleeding-edge to corporate adoption.

- **Integration and Growth Phase** -- Maturity of the intranet and the networked applications market, demonstrated cost savings and user experience will accelerate the use of network computer devices for specific applications.

By 2001 network computer devices and PCs will no longer be competing architectures. Instead, network computer devices and PCs will represent alternative form factors that both successfully exploit network computing software architecture.

Despite the advantages of network computer devices, META Group believes they will benefit a specific set of users in key application areas. Network computer devices are not the only way of achieving cost savings. Savings can be achieved by providing standardization on the desktop and network computing software architectures that are managed with explicit corporate policies and procedures. Well-managed PCs will be another workable means of controlling desktop computing costs. Well-managed PCs are more suitable for knowledge worker environments and users who must process information on local disks. Network computer devices without local storage will never be able to replace well-managed PCs in these environments.

META Group believes the PC market will completely adopt the application architecture concepts of the network computer devices. The first phase of this adoption includes the model of the well-managed PC. This will be followed by the future well-managed PC. Then, during the next two to three years, software vendors will rewrite their programs around what META Group calls a "logical NC" model, with all application-state information configured at the server, but cached on the client for local execution.

The cost of a well managed PC environment is midway between an unmanaged PC and a pure network computer device environment. The well-managed PC evolution will transition through three stages:

Stage 1 (2H97-1H98) — The well-managed PC uses Windows NT Workstation to lock down the client environment along with heavy use of third-party automated management tools for software distribution, inventory, metering, and remote control/diagnostics. The well-managed PC environment also requires a relatively strict level of standardization among PC platforms and end-user configurations.

Stage 2 (2H98-2H99) — The future managed PC exploits advanced embedded management features derived from PC and NetPC technologies including: Wake-ON LAN technology, preboot service agents, ACPI, plug and play, and DMI 2.0. The PC will run Windows 98 or Windows NT Version 5. Managed PC environments in this stage will move away from discrete management of the client toward continuous configuration management.

Stage 3 (2000-01) — The logical NC environment represents a complete implementation of a network-centric software architecture, including a shadow server to dynamically synchronize

data and applications between the client and server. We expect this full-function "logical NC" to appear by 2000 and represent the merging of the PC and network computer devices into a single spectrum of platforms with a single software architecture. The key ingredients of a logical NC client include most of the same technologies of the network computer devices.

However, managed PCs are not the ideal solution for all applications and environments either. The well-managed PC will not impact the need to update or replace expensively equipped PCs every three years when the computers no longer have enough processing power or available memory if applications are processed locally. Managed PCs also must be serviced at the desk for some repair or installation functions, because they contain data and configuration information that is stored locally on the system. This desktop service includes swap-out of the hard drive and occasional manual configuration with local applications. Desktop service drives up support costs. The network computer device relies on data and configuration information that resides entirely on the server. In the event of a hardware problem, the network computer device can be replaced in its entirety without the need to reinstall local software. Therefore, network computer devices can be more easily supported from a central location than today's PCs. Network computer devices cost $387 to support compared to $ 412 for a managed PC and $520 for an unmanaged PC.

Well-managed PCs would not necessarily solve many of the other problems being handled by the study participants. These include one or more combinations of the following issues:

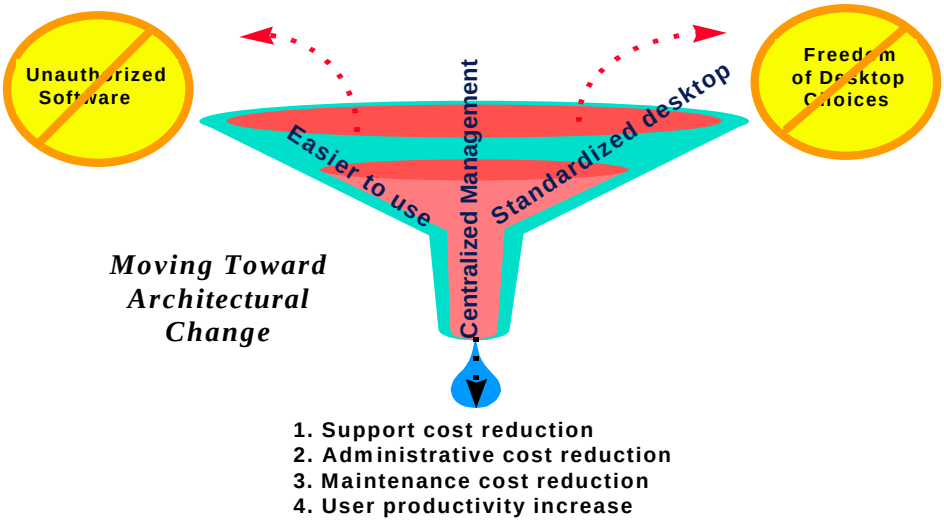
- Users spending time on operating system customizations and similar tasks
- The need for a service person to visit an individual desktop device because the problem cannot be identified or corrected from the server
- Users loading unauthorized software that causes problems in organizations where the disk drives are not permanently locked down
- Multiple different hardware configurations that, for valid business reasons. must be supported throughout the company. This is particularly true if corporate policy does not enforce a homogeneous desktop device running exactly the same version of all software and hardware releases throughout the organization.

Not surprisingly, network computer devices are not recommended as replacements for all PCs. Network computer devices are not well suited for all applications and for every environment. There are many applications and environments where they can or should not even be considered as an option. They are not well suited for workers that:

- Require large amounts of local processing power
- Are involved in application development projects with continual changes
- Require mobile or stand-alone operations
- Are heavy users of office automation and other productivity applications
- Work in an environment where the flexibility to add or change software and hardware is required

- Have networks that are bandwidth-constrained or unreliable

There are also tradeoffs needed to reap the full cost/benefit advantages of network computer devices; these are illustrated in the above figure. It is important to note that many of the advantages derive not only from the device itself, but also from standardization of desktop systems throughout the company. To derive real cost savings for the corporation, users must be willing to give up certain freedoms — among these are the freedom of desktop platform choice and the freedom to run whatever software they please. These tradeoffs will cause much consternation in Global 2000 companies for many years to come as users and IT managers decide how to best meet business needs of end-users.



IT can encourage users to migrate to network computer devices rather than impose or dictate policy, particularly for decentralized corporations. IT departments can create incentives for reluctant users to move to newer, more cost-effective devices by passing along the variable cost of increased support based on the device, application, and degree of flexibility required by the user. These same incentives should also be used to encourage migration to managed PCs where appropriate. The line-of-business units will determine an organization's ultimate course of action based on their willingness to spend money in return for a perceived benefit from technology. Long term, META Group believes IT managers should not attempt to mandate the use of network computer devices. Instead, IT should act as an internal consultant, pricing various alternatives along with their corresponding benefits and associated support costs.

META Group believes that organizations should view network computer devices with a tactical mindset, as opposed to a holistic PC replacement strategy. Companies should balance current gaps in managed PC environments against future improvements against a 2001 backdrop when many of the current weaknesses will be minimized or resolved. Until then this gives the network computer device a 3 year "benefit bubble" that diminishes over time as hardware and management capabilities of both devices become strikingly similar.

META Group cautions IT managers about the following issues which can adversely affect the adoption of any future desktop device. First, Java, a fundamental technology for many of these devices, is immature with limited application support. Second, when major productivity applications such as Microsoft Office begin executing on the server costs may increase significantly.

Finally, network computer devices will not make PCs obsolete any more than PCs made mainframes obsolete. They are just one more computing option for IT managers. Nonetheless, fundamental changes in the use of applications and access to data is imminent, because the cost pressures currently facing IT managers will spur virtually all organizations to make IT policy and systems management changes within the next 12 months. These changes will include better management of LAN networks and desktop clients, as well as the installation of network computer devices for specific vertical computing environments during the next three years. Server-based network computing will be an important part of this solution as well.

Bottom-Line Summaries from Actual Case Study Interviews

The following bottom-line conclusions are taken from the individual case studies found at the end of this report. These comments and quotations reflect the viewpoints of the IT managers who participated in this study. Each bottom-line point was articulated by at least one of the participating IT managers. These comments do not necessarily represent META Group's positions or conclusions.

- Corporate management in this organization is frequently asking IT to cost-justify new technologies and produce return-on-investment analysis for new architectures and solutions before they are deployed. The organization will be able to reinvest savings into additional applications, training, and end-user consultation to improve user productivity or gain competitive advantage. — *Industry: Healthcare*
- The real cost savings were realized in life expectancy of the hardware and reducing refresh rates. "The expected life cycle of a PC is not suited for a government." The cost of the desktop device is initially the same: approximately $1,200. The difference in savings comes about when after four years the desktop device doesn't need to be upgraded or replaced. — *Industry: City Government*
- Additional cost savings are anticipated as a result of gaining the ability to support applications and systems from a centralized location. — *Industry: Financial Services*
- The company is hoping to achieve a 2%-3% increase to its bottom line, though it may never be able to actually measure those costs. Anticipated benefits will come from use of the Internet and Web-based technologies. — *Industry: Financial Services*
- The company expects its software and hardware maintenance costs to decrease significantly. Software deployment costs will certainly reflect "significant savings" for the organization. — *Industry: Airline*

- The organization does not expect to see its application costs change or decrease. However, it is anticipating that it will get more productivity for each dollar spent on the network computer devices. — *Industry: International Air Cargo*
- The hope is that by using network computer devices the company will be at least 25% more productive with the same headcount as today. This expectation is based on the assumption that users who are not "futzing" with operating systems, DLLs, and other system-level tuning will be able to spend more time learning to use the applications efficiently. — *Industry: Airline*
- Error handling is expected to be much improved over the existing solutions, because the PC's general protection faults and other operating system errors are not seen on the AS/400. Also, error processing appears to be much faster on the network computer devices and whenever the desktop device is centrally managed. The company's IT department also is looking forward to being able to centrally process software patches and updates. — *Industry: Food Manufacturing*
- The most unexpected result this company experienced when it installed the pilot systems was in the area of overall performance. Because the company is migrating away from pure text to graphics and more complex data manipulation, the IT team anticipated up to an 8x performance hit. In fact, the network computer devices were able to deliver a performance throughput that was almost equivalent to a 200MHz Windows 95 PC. Considering the vast difference in price between the fully loaded PC and the minimal network computer device, company managers said they were "pleasantly surprised." — *Industry: Food Manufacturing*
- The network computers seem to have proven that they will be able to run legacy and state-of-the-art mission-critical applications, supporting bill of materials, parts inventory management, etc. — *Industry: Automotive*
- By having a standardized desktop platform, it expects to be able to reduce the total cost of ownership of desktops within the company. — *Industry: Airline*
- In the area of mechanical CAD applications, the software that is critical to this company's design and development of new products runs on workstations. Network computer devices cannot replace these mission-critical applications and will be unable to access the software. Eventually, all the CAD software will be ported to servers where the application and data can be run by network computer devices. — *Industry: Automotive*
- No changes in application support costs are anticipated once network computer devices are deployed. — *Industry: Automotive*
- A major concern still revolves around the network costs and upgrades. Current pilot tests seem to be generating a significantly greater amount of network traffic than the dumb terminals did. — *Industry: Automotive*
- "Our IT department wants to be able to centrally control and manage which applications are running and where they are being deployed." — *Industry: Manufacturing*

- The existing legacy computer systems are showing their age and beginning to become difficult to support or keep running. Network computer devices may be a good alternative, because many of the applications can be fixed and the devices are cost-effective and "disposable." — *Industry: Manufacturing*
- "Our company is battling a dilemma. While the advantages of network computer devices are clear, we see voice and multimedia capabilities as a valuable and desirable marketing tools. Our company wants to be able to easily locate and display last season's items. We recognize that multimedia interaction could reduce the amount of sales time and deliver what the customer really wants. This would cut down on returns and increase customer satisfaction. However, none of the network computer devices that would easily fit into our environment are capable of supporting the company's multimedia visions. Consequently we are still evaluating whether a Windows-based multimedia PC may be a better choice than network computer devices for them." — *Industry: Retail*
- Network computer devices will dramatically reduce the training time for seasonal and temporary employees. — *Industry: Retail*
- Browser-based network computer devices would let the market company's employees do a better job selling products, servicing customers, and tracking products, and would enable them to run many off-the-shelf customer care applications, including package tracking. These applications simply cannot perform as well on text-based terminals. — *Industry: Air Cargo*
- The network computer devices that this company has been evaluating have problems running off-the-shelf applications. The problems involve having to implement a WinFrame Citrix server in order to run Windows applications. This means IT will have to install a new type of server, which increases the risk of failure and adds an additional support requirement on the help desk staff. — *Industry: Financial Services*

Real Cost of Ownership of Network Computer Devices — Introduction

I. PURPOSE AND SCOPE

Real cost of ownership (RCO) analysis helps companies determine their operational costs down to the component level. It is important to correctly assess cost of ownership, both to determine correct pricing of IT services and equipment and to ascertain whether chargeback costs are being evaluated correctly. As a tool or discipline within an IT shop, RCO metrics can be used to explain costs, justify new technology investments, or benchmark IT operations. RCO can be used to improve the efficiency of an organization, because it flags the areas where cost structures are out of line with projected operational budgets. Organizations may use RCO for such activities as determining reasonable head counts or assessing the need for outsourcing certain IT functions.

Network computer devices are fueling debates about RCO across the entire computer industry. Proponents of network appliances reason that these devices, because of their low cost, will open up a market of home and business users who previously could not afford computing technology. Opponents argue that the software and networking costs of maintaining the devices and bulking up the LAN and WAN infrastructures to support network computers will easily eliminate any savings gained in reduced hardware costs. Opponents also argue that users will not accept being dictated to by their IT departments and will never give up disks and full-powered Windows-based PCs.

The introduction of network computer devices adds a whole new dimension to controlling, managing, and operating desktop computing platforms. Due to a lack of standardization in workstation hardware and operating systems, organizations currently expend significant resources, time, and money in maintaining desktop computing. Consequently, administration and management of these environments is expensive, complex, and time-consuming. Continuous investments must be made in new workstation hardware, software upgrades, and maintenance to support evolving application and network resource requirements.

This study is not a competitive analysis of products in the market but an analysis to help IT managers understand the real costs of ownership of network computer devices. META Group will examine cost structures and companies' investments in hardware, software, networking, management, support, and training associated with network computer devices. We will also look at the positive and negative benefits associated with these devices. Together, the actual costs and perceived benefits help determine the real cost of ownership. Network computer devices are currently deployed into heterogeneous environments containing terminals as well as Unix and/or Windows-based PC clients. Regardless of the environment network computer devices are placed in, specific network computer device costs will be broken out from the aggregate, and each of the classifications of network computers will be judged on their own merit and costs.

II. STRUCTURE OF THIS REPORT

The report is divided into the following sections:

- **Executive Summary** — This is the summary of all the quantitative and qualitative findings in this report and will be a standalone document for the sponsors of this study.
- **Introduction** — The first section details the scope and definition, description of the structure of the report, research approach and methodology, and the demographics of the respondents who participated in the survey process.
- **Quantitative Analysis of the RCO Data** — The analysis of the quantitative portion of the actual RCO data for the PCs and network computer devices is located in this section.
- **Qualitative Analysis of the RCO Data** — Half of the survey was devoted to gaining an understanding of the business drivers, benefits, and drawbacks for the users who participated in the survey process. This portion of the report is devoted to reporting the results of the essay portion of the questionnaire and the follow-up phone interviews. It also includes META Group analysis of this purely qualitative research.
- **Actual Survey Data Analysis** — META Group presents the actual data results of the survey and interviews that were obtained from the participating companies, along with further analysis of these results.
- **The Case Study Reports** — These case study details represent the typical opinions, experiences, and strategies of 16 of the study participants.
- **Appendix A: The Survey Questionnaire** — The actual survey questionnaire used in this study is included.

III. RESEARCH APPROACH AND METHODOLOGY

This study represents primary research into determining the steady-state costs associated with all classes of network computer devices. In part, META Group wanted to understand companies' projected or real investments in — and costs associated with — network computer devices hardware, software, networking, management, support, and training.

META Group created a list of questions for senior IT managers to complete. META Group sent copies of the questionnaire to 52 Global 2000 companies and conducted interviews at each of the companies with Intel-based desktop computers running the Microsoft Windows operating system (Windows-based PCs) and/or where network computer devices are being used, evaluated, or seriously considered for future use. META Group chose these companies from its client base and from names supplied by sponsors of the study. Moreover, we collected the information even if a company was still in the evaluation stage or doing preliminary or limited deployment of network computer devices. Eighteen companies furnished detailed financial data regarding their operational and support costs. The other companies provided partial data or qualitative results that were factored into this study. To obtain additional cost and qualitative data beyond the questionnaires, we conducted live telephone interviews. META Group holds all information collected in the strictest of

confidence, and will not release any information about these participating companies without their permission.

We used this information to calculate the real cost of ownership for the classifications of network computer devices listed below, including Windows-based PCs. It is not META Group's intention to perform a competitive analysis of the different platforms. Instead, we will analyze the costs and benefits associated with the following four classes of desktop/client computer devices.

- NetPCs
- Network Computer/JavaStations
- Network Stations/Explora and HMX/host-based terminal replacements
- Windows-based PCs

The project tasks entailed developing real cost of ownership (RCO) models across various operating environments. The study focuses on business environments and considered the following buying criteria:

- New installations versus addition or replacement of network computer devices into existing environments
- The nature of applications utilizing network computer devices
- Benefits and drawbacks of the network computer devices
- Direct and indirect costs of ownership

Throughout the study, we ascertained additional costs of the network computer devices for both IT and line-of-business users with regard to the following parameters:

- Hardware
- Software
- Administration
- Support
- Network infrastructure
- Systems and network management
- Training
- Qualitative data on costs of application development and maintenance

The study is also based on research that META Group has done in determining the cost of IT systems management and total cost of ownership for various platform configurations.

Throughout this study, META Group uses proven research methodology, basing the study on assessments of RCO changes that can be attributable to network computer devices.

IV. DEMOGRAPHICS OF THE RESPONDENTS

Case study participants were assembled from companies in 13 different vertical industries and included sponsor customers, META Group clients, and the wider population of companies in various stages of evaluating or deploying network computer devices. Case study participant organizations ranged in size from $5.5 million to $24 billion in revenues, and from 450 to more than 100,000 users. Almost half of the participants were Global 500 companies. The companies were located in as few as one single location to as many as more than 2,000 geographic locations. The people who actually completed the survey or organized the collection of data and participated in the interviews were primarily IT managers. Their titles included vice president, director of operations and support, director, manager, and analyst.

Table 1 is a sampling of the companies that participated in this report. While there were many overlapping industries, the table offers an example of the diversity of the respondents.

Table 1 — Sample of Case Study Participant Demographics

Industry	*Average Revenue*	*Geographic Locations*	*Number of Users in Organization*
Healthcare	>$6 billion	26	12,000
Airline	>$2 billion	>50	21,000
Manufacturing	>$80 million	1	450
Retail	>$1 billion	8	7,000
Automotive	>$9 billion	7	36,000
Government	NA	10	700
Airline	>$17 billion	>200	90,000
Telecommunications	>$24 billion	>2,000	110,000
Financial Services	N/A	7	25,000
Government	N/A		
Chemical	>$16 billion	>400	18,000
Education	N/A	3	880
Telecommunications	>$19 billion	>1000	63,000
Air Cargo	$>10 billion	>1000	100,000
Transportation	$>10 billion	N/A	50,000
Manufacturing	$5.5 million	>100	50,000
Communications	>$10 billion	900	4,500

Analysis of the Quantitative RCO Findings

The section of the report presents the numerical results of the RCO data for a typical unmanaged PC/LAN environment, the pure network computer device environment, and a well-managed PC/LAN environment.

I. Definition of Network Computer Device

META Group defines a network computer device as one within a broad class of computing devices that use various PC technologies to gain access to networked or Web-based environments. For the basis of this study, these are stateless machines that rely on servers to store all volatile data and software, except for information that may be temporarily cached in RAM or in some instances on disk. All applications and data that are stored on a server may be automatically refreshed for local processing at the desktop. Most network computer devices are diskless, and all can run network browsers locally. Depending on the particular vendor's network computer product and its targeted application, network computer devices may be equipped with any or all of the following technology components.

- Processor
- Microkernel
- Graphical user interface or Internet browser
- RAM
- Modem
- Monitor
- Keyboard
- Network interface card
- Expansion slots

Some vendors also include ROM, floppy, or hard disk options. For this survey, the broad terminology "network computer device" will be used to describe all classes and brands of network computer devices.

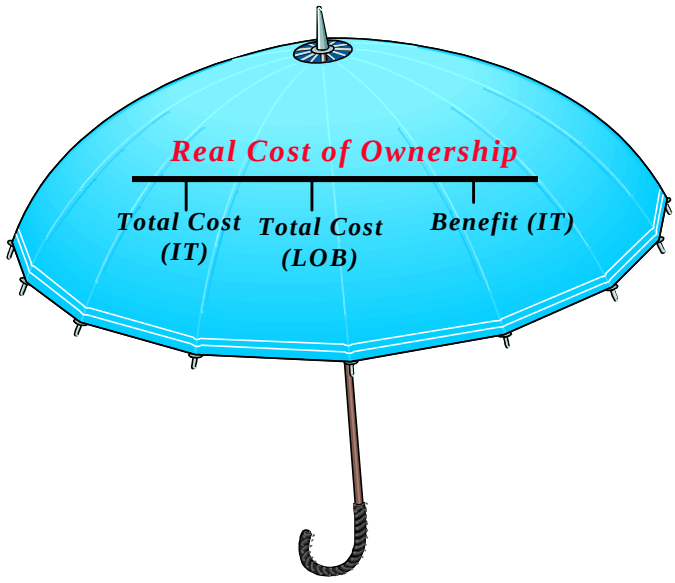
II. Real Cost of Ownership — Definition and Explanation

Real cost of ownership is a methodology used in this study to measure the costs associated with owning and operating network computer devices and Windows-based PCs in a steady-state environment. Steady-state environments include the ongoing daily costs of operating equipment or technology and exclude the startup costs associated with migrating a department

or company to a new product. The META Group RCO model is designed to provide the framework for companies to understand steady-state operating costs associated with their operational costs down to the component level. The META Group RCO model also factors together the total cost of ownership with the benefits of the technology to the users and corporation.

Most IT budgets do not incorporate shadow support or recognize the productivity cost associated with users operating client machines. For this reason, shadow IT costs were not measured as part of this study. IT costs can be accurately quantified in dollars or in full-time equivalents (FTEs). The LOB cost and benefit sections of the RCO model are often determined through subjective or qualitative analysis, which META Group has captured as qualitative analysis. As a result, IT organizations must often compare quantitative cost projections against qualitative benefits when making technology decisions, instead of traditional return-on-investment analysis. Figure 1 graphically depicts this concept.

Figure 1 — Components of Real Cost of Ownership



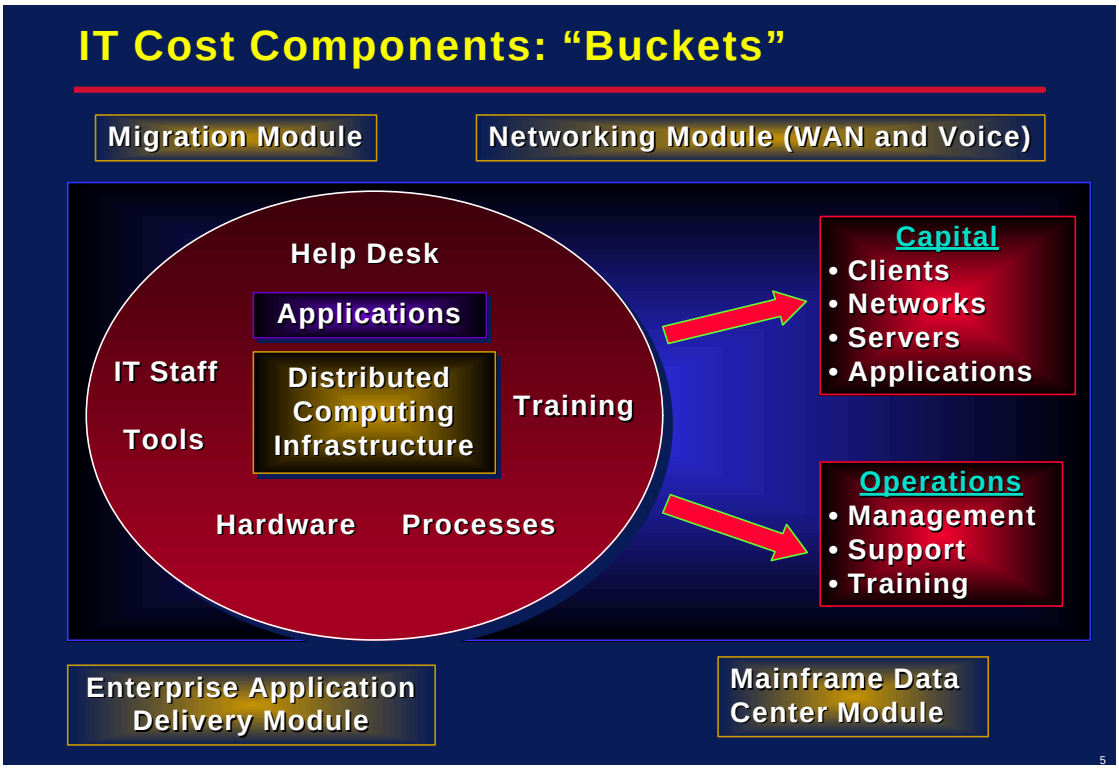
In the META Group RCO model, the costs of the distributed computing infrastructure are separated from other major cost components, such as WAN and voice networking, data center, and IT migration. The distributed computing cost model quantifies cost regardless of the desktop computing paradigm. As shown in Figure 2, distributed computing costs are broken down into two core components: capital and operational costs.

Capital Costs

Capital costs include the costs for hardware and software across all desktop devices, servers, networks, and applications. Capital costs are more easily quantified, because they are already available in dollar amounts. Traditionally, capital costs have been thought of as insignificant versus operational costs. However, capital costs virtually equal operational costs when all costs — including those of clients, networks, servers, and applications — are factored into the model. Capital costs for distributed computing breakdown further into the following cost components:

- **Client** — Includes the client PC or network computer device hardware, monitor, and modem, as well as other peripheral devices. It also includes the software, operating system, utilities, middleware, and supplemental software services.
- **Network** — LAN-based for this study, it includes hubs, routers, switches, cable, and infrastructure.
- **Server** — Includes hardware and software, such as server operating system, Web functionality, middleware, and supplemental server services.
- **Application** — Includes the cost of the applications and ongoing upgrades. For this study, only workgroup and office productivity applications (e.g., groupware, e-mail, browser, word processing, spreadsheet) were considered. Enterprise applications such as SAP were not included.

Figure 2 — How META Group Delineates Cost Components



Operational Costs

Operational costs are primarily based on the full-time equivalents (FTEs) that are required to manage, support, and train users in a distributed computing environment. Operational costs can be measured by taking the total number of FTEs and translating this number into a dollar value using salary and load figures. Alternatively, operational costs may be determined using a "bottom-up" approach, which involves quantifying specific management and support tasks and aggregating the task costs into a single dollar value for the entire environment. In either situation, operational costs are further quantified into the following components:

- **Management and administration costs** include the proactive and day-to-day operations of the distributed computing infrastructure. Resource management, network and systems monitoring, and application administration all fall into this category.
- **Support costs** are generated in responding to problems in the distributed computing environment and taking the necessary corrective actions. Typically, these tasks are formalized under a multitier help desk structure.
- **Training costs** include the price of the courseware and materials used to educate users on becoming familiar and productive with their PCs and applications. Training costs also include the ongoing cost of keeping IT staff current on the latest technologies and products.

Operational costs can be influenced to some degree by any of the following factors.

- **Degree of standardization** is the level of homogeneity of products across clients, servers, networks, and applications.
- **Application mix** includes the type and number of applications, security, and availability of the application portfolio. Certain applications such as airline reservation systems are internally written, updated frequently, and mission-critical to the business. As a result, these dedicated applications will be more expensive to support. Many of the application operational costs will be related to fault-tolerant measures, including sufficient staffing required to minimize the mean time to problem resolution.
- **User population** refers to the number of users and their geographic dispersion. The economy-of-scale phenomenon for large organizations has an enormous impact on many operational costs. The larger the number of users, the more staff it takes to support them, and the more often problems will occur. Moreover, the geographic location of end-user sites is an important factor. Remote users often must have someone on-site to fix problems or install software. Companies pay a premium when there is no IT on-site and the operational, support, and maintenance tasks must be outsourced.
- **Service-level requirements** are the guaranteed response times and the resolution rates for help desk calls.
- **IT management infrastructure** is the most effective way to reduce technology costs without eliminating the perceived value that IT provides to business units. This

infrastructure includes automated management tools such as electronic software distribution, hardware and software inventory tools, remote control, help desk trouble-ticketing, and knowledgebase tools.

There are many cost factors over which IT has no control, including proximity of managed assets and application criticality. In these situations, IT organizations must negotiate certain cost factors (e.g., network or CPU performance, service levels) with individual departments or business units. The outcome depends on the organization's willingness to spend money in return for improved service offerings.

III. QUANTIFYING THE REAL COST OF OWNERSHIP FOR NETWORK COMPUTER DEVICES

For this study, corporations were asked to supply information regarding the costs of their existing PC/LAN environments and their network computing environments, whether the network computer device was being proposed, in pilot, or in early deployment. PC/LAN costs were measured to form a baseline for evaluating the impact of network computing to the overall distributed computing cost structure.

Survey data revealed that most organizations surveyed do not have a clear understanding of how much their distributed computing environments cost to operate, regardless of whether the company utilizes a traditional PC/LAN or installs network computer devices. Many of the participating executives knew their company would need to institute some changes to the server or networking infrastructure to support network computer devices, but very few knew the extent of those changes or how much they would cost the organization.

Most companies participating in this survey were in early evaluation or pilot stages of deploying network computer devices. Consequently, the majority of respondents could not always fully document what the steady-state costs would be for a network computer device in their organization. While most of the respondents were able to supply much of the RCO data we required on their operational, network, hardware, software, and administration data, few were able to comprehensively quantify their total support costs or their steady-state costs for network computer devices. This is due in part to the fact that many of the devices had only been in place for a few months at the time the survey was done. META Group used real cost data supplied by the participants in the data whenever possible. To calculate a bottom-line figure, in some instances we also used a collective set of data from previous RCO studies and other primary research. As a result, META Group is relying on both qualitative data from the survey along with META Group analysis to estimate the true operational costs. These costs are used to compute the complete RCO values for PC/LAN and network computing environments.

Definitions and Desktop Platform Categories

META Group quantifies the annual capital and operational costs for the client, server, and network components for the three different desktop environments in the following two

sections of this report. As part of this assessment, META Group considers the annual steady-state or ongoing capital and operational costs for the different types of desktop clients. It is important to note that META Group attempted to obtain different costs for each classification of the network computer devices: NetPC, NC/JavaStation, and host-based terminal replacement devices from IBM, NCD, and other vendors. However, the majority of companies surveyed were evaluating more than one type of device from more than one vendor. In addition, according to the participants of this survey the variation in cost of ownership between different products or the same class of products from different vendors is not statistically significant. META Group has combined all three classifications into one "bucket" for this portion of the RCO cost analysis section of the report. For the purposes of this study, this bucket is called the *pure network computer device environment.*

Well-managed PCs will be another workable means of controlling desktop computing costs. Well-managed PCs are more suitable for knowledge worker environments and users who must process information on local disks. Network computer devices without local storage will not be able to replace well-managed PCs on a large scale in these types of environments.

While network computer devices are an important solution over the coming years, META Group believes the PC market will adopt the application architecture concepts of the network computer devices. The first phase of this adoption includes the model of the well-managed PC. This will be followed by the future well-managed PC. Then, during the next two to three years, software vendors will rewrite their programs around what META Group calls a "logical NC" model, with all application-state information configured at the server, but cached on the client for local execution.

META Group uses the following terms and definitions to classify the type of distributed computing environment that is analyzed and measured in this study.

- **Typical Unmanaged PC/LAN Environment** represents the average Windows-based PC and LAN environment of Global 2000 organizations. META Group defines this as a mix of business-class PCs, typically running over a network operating system (NOS) such as NetWare or Windows NT for network services.
- **Well Managed PC/LAN Environment** uses technologies such as Microsoft's Zero Administration toolkit to lock down the client environment along with heavy use of third-party automated management tools for software distribution, inventory, metering, and remote control/diagnostics. The well-managed PC environment also requires a relatively strict level of standardization among PC platforms, application versions, and end-user configurations. Well-managed Windows-based PCs are becoming available now and will proliferate throughout 1998 and into 1999.
- **Pure Network Computer Device Environment** encapsulates the concept of IT reclaiming the majority of computer processing, RAM, and disk resources, and operating them in a centralized, controlled, and standardized fashion from within the IT data center. Clients in this class are often called slim or thin clients. These devices are primarily designed to deliver applications and data to users over the network

infrastructure. Our calculations assume pure network computer devices are either one of the following types of systems: dumb terminals in which all applications execute on the server and only screen refresh information that is sent to the client; or Java-based clients where some application logic is downloaded to the client as Java applets. Since no NetPCs or NCs actually had shipped during the data collection phase of this study, actual data calculations for this category only include JavaStations, and host-based terminal replacement devices.

IV. ANNUAL CAPITAL COST COMPARISON IN DISTRIBUTED DESKTOP ENVIRONMENTS

The following section compares the annual capital cost differences between operating PC/LAN and network computing environments. Table 2 shows the summaries of these annual capital costs based on the type of distributed computing environment.

Client Capital Cost Comparison in Different Desktop Environments

Client capital costs include client hardware, monitor, upgrades, and operating system fees, as well as the client component of workgroup-level applications such as e-mail, browser, and office applications. The client capital costs do not include enterprise-class applications such as SAP. Final client cost figures also assume that the cost of the client is being amortized over three to five years. The cost data used to support the META Group analysis of client capital costs in a typical unmanaged PC/LAN environments is located in Appendix A.

- **Typical Unmanaged PC/LAN Environment Client Capital Costs**

  According to the survey data, the client in a typical unmanaged PC/LAN environment costs a company an average of $1,066 per year (see Table 6 for more details).

- **Well Managed PC/LAN Environment Client Capital Costs**

  META Group research indicates the price of corporate-class PC desktop hardware has declined rapidly over the past year as the cost of PC hardware components continue to become less expensive and competition among PC vendors increases. Factoring in quantity discounts from vendors, META Group expects the cost of business PC hardware to drop 30% over the next 12 months. Consequently, factoring in the lower costs for PCs, META Group calculates that the well managed PC/LAN environment capital cost will be $787 per client per year.

- **Pure Network Computer Device Environment Client Capital Costs**

  Assuming the set of costs for the operating system and applications are similar to the Well managed PC/LAN environment, META Group predicts that client capital costs for network computer devices will average $592 per user per year.

Network Capital Cost Comparison in Different Desktop Environments

Network capital costs include LAN hubs, routers, and switches. These costs do not include WAN or voice equipment.

- **Typical Unmanaged PC/LAN Environment Network Capital Costs**

  Survey participants were unable to provide quantifiable data for their typical unmanaged PC/LAN environment network capital costs; META Group estimates an average of $196 per node for a mix of shared and switched Ethernet technologies. This estimate is based on META Group's internal analysis and cost modeling.

- **Well Managed PC/LAN Environment Network Capital Costs**

  META Group predicts the typical LAN infrastructure will need to be upgraded to handle an increase in network traffic that will result from this new paradigm. Additional network traffic in the well managed PC/LAN environment will come from PC/LAN management tools, more frequent electronic software distribution, and an increase in browser-based computing. META Group estimates there will be a 20% increase in annual network capital costs for such infrastructure upgrades (e.g., hubs, routers, switches). This results in a calculated cost for the well managed PC/LAN of $215 per user per year.

- **Pure Network Computer Device Environment Network Capital Costs**

  A pure network computer device environment will demand a robust and scaleable network infrastructure. META Group analysis predicts that a 20% increase in network infrastructure investment is required to handle the increased bandwidth requirements to support large installations of network computer devices. The pure network computer device capital cost for networking is calculated to be $234 per user per year.

Server Capital Cost Comparison in Different Desktop Environments

Server capital costs include the server platform, the operating system and/or network operating system, and the server component of workgroup-level applications. The cost data used to support the META Group analysis of server costs of a typical unmanaged PC/LAN environments are found in Appendix A.

- **Typical Unmanaged PC/LAN Environment Server Capital Costs**

  Survey participants indicated their own server capital costs ranged from $34 to $256 per attached client, with the average cost at $144 per client per year for a typical unmanaged PC/LAN environment.

- **Well Managed PC/LAN Environment Server Capital Costs**

  META Group analysis predicts that the cost of servers in well managed PC/LAN environments should remain constant. Well managed PC/LAN environments will require minimal additional processing, RAM, and storage. However, META Group expects this increase to be offset by continued price cuts and competition between server vendors. The server capital costs are estimated to be $199 per attached client per year.

- **Pure Network Computer Device Environment Server Capital Costs**

  A pure network computer device environment will require some additional investment in server platforms to accommodate the shift of processing, RAM, and disk from the client to the server. Survey participants anticipate that they will require an increase of

15%-25% in server capital investment to run network computer devices. META Group analysis and cost modeling indicate an approximately 20% increase in server costs for a pure network computer device environment. This results in a capital server cost of $237 per attached client per year.

Table 2 —
Summary of Annual Distributed Computing Capital Costs for Each Environment

Capital Cost Component	*Unmanaged PC/LAN Environment*	*Well Managed PC/LAN Environment*	*Pure Network Computer Device Environment*
Client Component includes client hardware, monitor, upgrades, OS fees, and the client component of workgroup-level applications.	Survey data shows an average cost of $1,066 per client per year.	META Group predicts the cost of PC hardware will drop 30% over the next year. This results in a reduced capital client cost of $787 per client per year.	META Group predicts the client capital costs to be $592 per client per year.
Network Component includes LAN hubs, routers, and switches.	META Group analysis and cost modeling indicate an average of $196 per node per year	META Group estimates a 20% increase in annual network capital costs, for a cost of $215 per node per year.	META Group predicts a 20% increase in network infrastructure. Networking capital cost is $234 per node per year
Server Component includes server platform, OS or NOS, and server component of workgroup-level applications.	META Group calculates server costs of $144 per attached client per year.	The server capital costs are $199 per attached client per year.	Survey participants indicate an increase of 15%–25% in server investment. META Group analysis and cost modeling predict $237 per attached client per year.

V. ANNUAL OPERATIONAL COST COMPARISON IN DISTRIBUTED COMPUTING DESKTOP ENVIRONMENTS

In this section, META Group compares the annual operational cost differences between operating PC/LAN and network computing environments. Operational costs include those costs earmarked for management and administration, support, and training. Table 3 shows summaries of these annual capital costs based on the type of distributed desktop computing environment.

Management and Administration Cost Comparison in Different Desktop Environments

META Group quantifies management costs by examining the ratio of users to IT administrators. The ratios vary greatly; META Group has observed Global 2000 company ratios ranging from 50:1 to 150:1, depending on the location, environment complexity, quality of services, etc. Survey participants had difficulty correlating their company's IT staff to the number of users or clients in their environments. This was largely due to the variation in IT organizational structures found in these companies.

- **Typical Unmanaged PC/LAN Environment Management and Administration Capital Costs**

  For the study, META Group uses a 75:1 user-to-IT ratio with an average burdened load of $80,000 per IT staff member. META Group calculates that this ratio results in an annual management cost of $834 per client annually.

- **Well Managed PC/LAN Environment Management and Administration Capital Costs**

  META Group analysis predicts well managed PC/LAN environments will be cheaper to manage and administer. Remote management, software distribution, and client standardization are three key reasons for this decrease. Specifically, META Group cost modeling shows significant savings in client management and configuration costs, which should translate into reduced employee head count or rededicated IT staff. These reductions in client management are slightly offset by a predicted increase in network management. Overall, META Group estimates annual management costs in well managed PC/LAN environments of $728 per client.

- **Pure Network Computer Device Environment Management and Administration Capital Costs**

  Since survey participants indicated that the client management and administration costs make up the most significant portion of their overall cost structure, most of the respondent companies said they expect to achieve a net savings in these costs by moving from their current desktop devices to network computer devices. META Group cost modeling assumes network and server management increase 20% over the typical unmanaged PC/LAN environment. Client management costs approach zero, because the clients are managed and administered centrally. The result is a management cost of $678 per client each year.

Support Cost Comparison in Different Desktop Environments

META Group quantifies support costs by examining the ratio of users to help desk support staff. This ratio varies greatly, depending on service-level agreements, complexity of the environment, and organizational priorities. META Group cost modeling uses a ratio of 400:1 for the proportion of users to Level 1 help desk staff. Furthermore, META Group uses an average loaded salary of $56,000 for Level 1 staff members. Level 2/3 (break/fix) support typically comes from IT administrators who spend a portion of their day on support call.

- **Typical Unmanaged PC/LAN Environment Support Capital Costs**

  Combined, Level 1 and Level 2/3 costs for a typical unmanaged PC/LAN environment are $520 per client per year.

- **Well Managed PC/LAN Environment Support Capital Costs**

  META Group analysis predicts that well managed PC/LAN environments will be less costly to support than the current typical unmanaged PC/LAN. Specifically, the break/fix component of support — as opposed to "how-to" questions — should be significant reduced by employing a more standardized client platform, hardware, and operating system, along with remote diagnostic tools. META Group estimates well managed PC/LAN environments will cost $412 per user per year to support.

- **Pure Network Computer Device Environment Support Capital Costs**

  Pure network computer device environments will experience a dramatic reduction in client break/fix support costs. As in the management case, network and server support costs are anticipated to offset the client support reduction. However, the net effect should be a cost savings compared to a typical unmanaged PC/LAN environment. Although unable to detail anticipated support savings, survey participants felt that their overall support costs may drop as much as 30% in a pure network computer device environment. META Group estimates support costs to be $387 per client.

Client Training Costs Comparison in Different Desktop Environments

Most survey participants did not have a clear understanding of their training costs. Using META Group cost modeling and analysis of its client base, META Group assumes that an average of 25% of users and 100% of IT staff receive training annually.

- **Typical Unmanaged PC/LAN Environment Training Capital Costs**

  META Group analysis indicates the cost for PC/LAN environment training is $64 per user per year.

- **Well Managed PC/LAN Environment Training Capital Costs**

META Group estimates that training costs in well managed PC/LAN environments should remain similar to current costs. This is because the infrastructure will not have changed significantly to alter those costs. The well managed PC/LAN environment will have similar elements (e.g., Windows, Win32 applications, an underlying network operating system) that

will require the same level of training needed to become proficient with current Windows-based PCs.

- **Pure Network Computer Device Environment Training Capital Costs**

  META Group estimates that training costs in a pure network computer device environment will be lower than those in a typical unmanaged PC/LAN environment, because users are working with a less sophisticated device and an operating system with fewer features. META Group estimates training costs to be $48 per user per year.

Table 3 — Annual Operational Costs for Distributed Computing

Operational Cost Component	*Typical Unmanaged PC/LAN Environment*	*Well Managed PC/LAN Environment*	*Pure Network Computer Device Environment*
Management and Administration META Group analysis shows a common ratio of 75:1 with an average burdened load of $80K per IT staff member.	META Group calculates an annual management cost of $834 per client per year.	META Group estimates management costs in well managed PC/LAN environments to be $728 per client annually.	META Group cost modeling assumes network and server management will increase 20%, and client management costs will near zero. The result is a management cost of $678 per client per year.
Support META Group cost modeling uses a 400:1 ratio for users to Level 1 help desk staff, plus an average loaded salary of $56K for a Level 1 staff member and Level 2/3 support.	Combined Level 1 and Level 2/3 support costs are $520 per client per year.	META Group estimates well managed PC/LAN environments will cost $412 per user per year to support.	META Group expects support costs in this category to be $387 per client.
Training META Group cost modeling assumes 25% of users and 100% of IT staff receive training annually.	META Group analysis indicates this cost is $64 per user annually.	META Group expects training costs in well managed PC/LAN environments to remain similar to current costs.	META Group estimates training costs in pure network computer device environments will be $48.

Table 4 —
Finalized Distributed Computing Environment Capital and Operational Costs

Cost Component	*Typical PC/LAN Environment (from Survey Data)*	*Well Managed PC/LAN Environment*	*Pure Network Computer Device Environment*
Capital Costs			
Client (with applications)	$1,066	$787	$592
Network	$196	$215	$234
Server	$144	$199	$237
Total Capital Costs	$1,406	$1,201	$1,063
Operational Costs			
Management	$834	$728	$678
Support	$520	$412	$387
Training	$64	$64	$48
Total Operational Costs	$1,418	$1,204	$1,113
Total RCO Costs	$2,824	$2,405	$2,176

Figure 3 — Breakdown of Capital Costs in Three Different Distributed Computing Environments

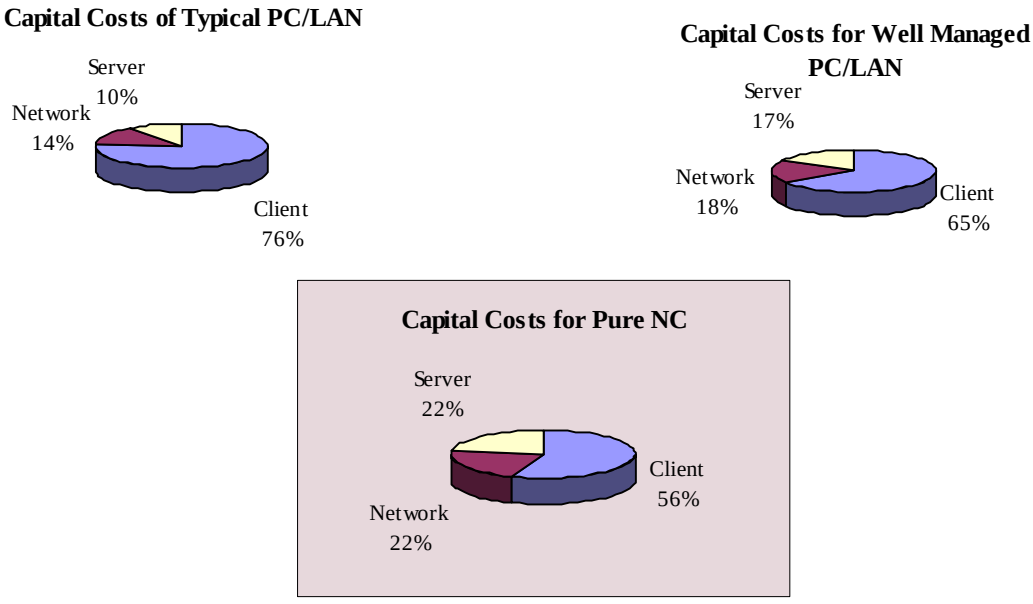


Figure 4 — Annual Client, Server, and Network Capital Costs in a Distributed Environment

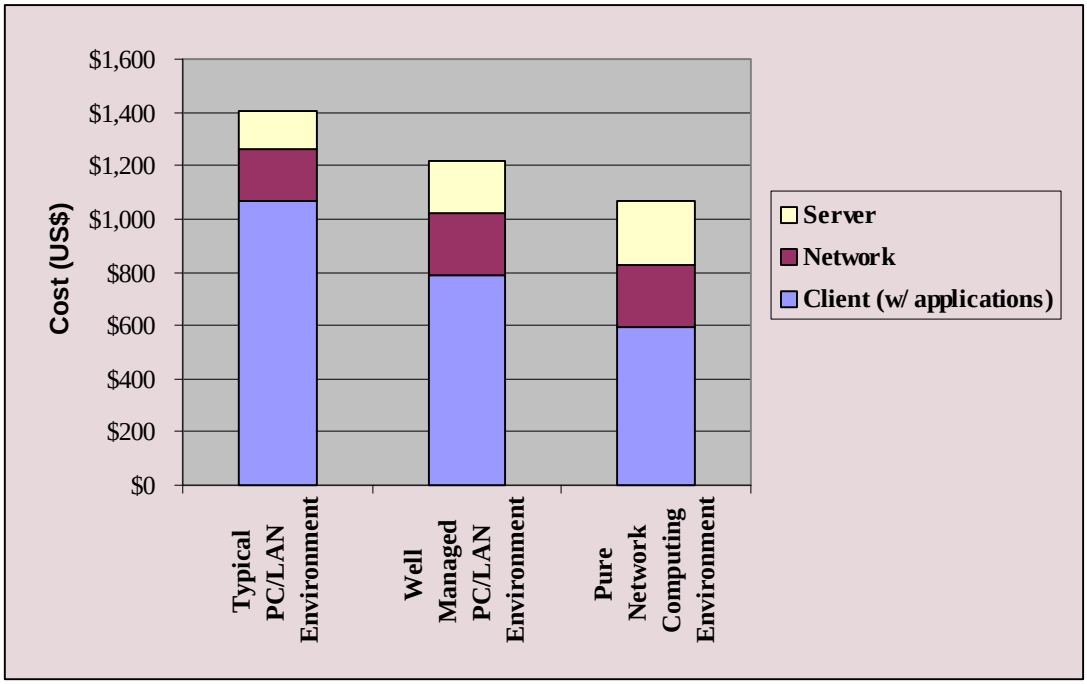
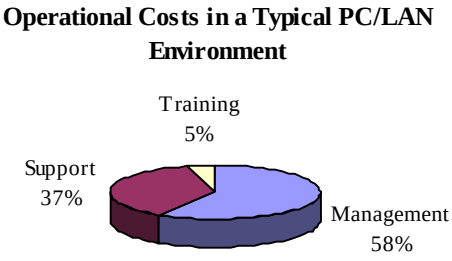
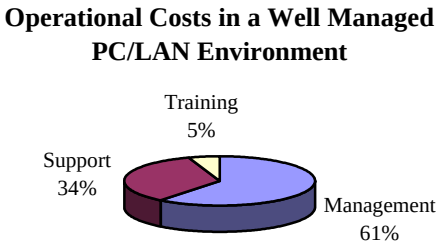


Figure 5 — Breakdown of Operational Costs in Three Different Distributed Computing Environments





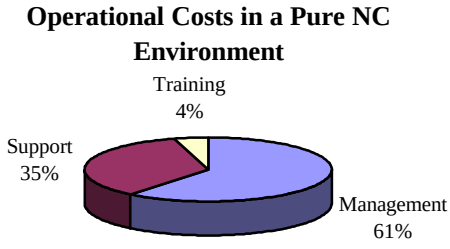


Figure 6 — Annual Operational Costs in Distributed Client Computing Environment

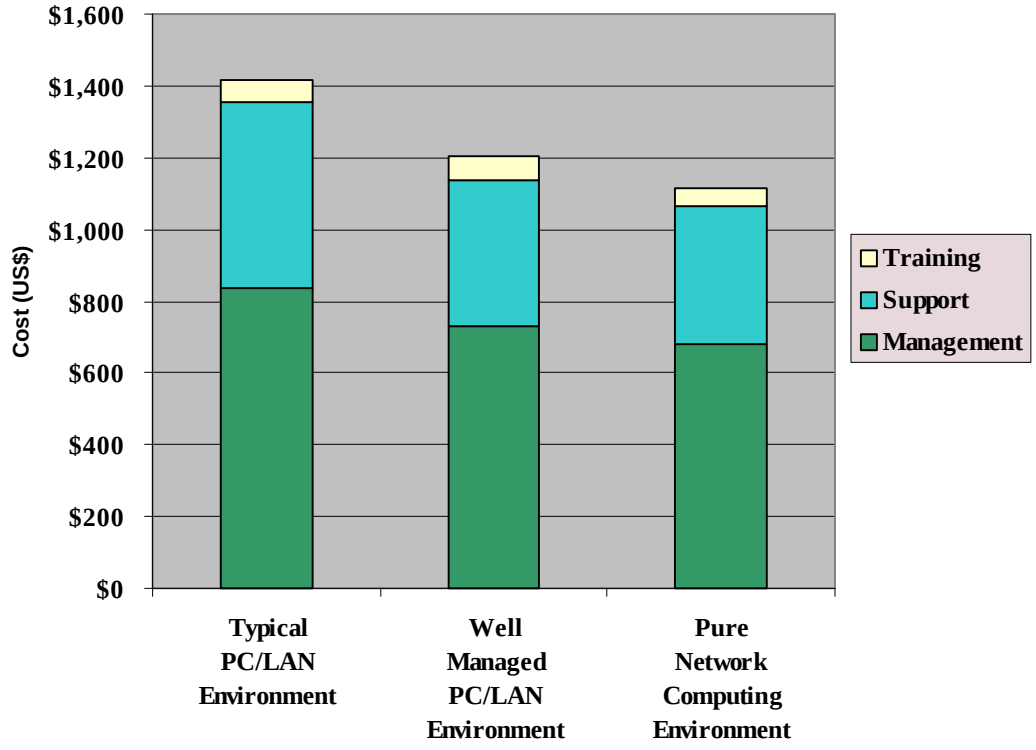
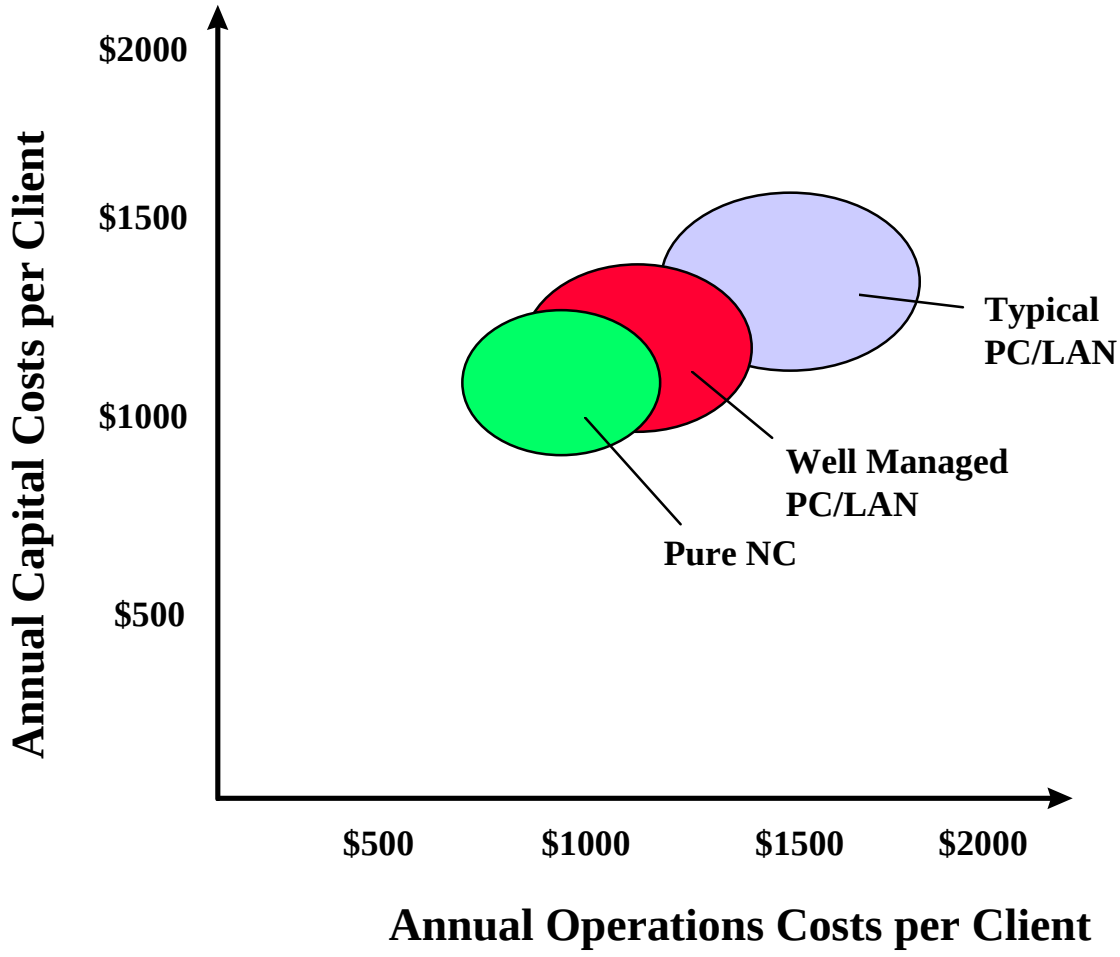


Figure 7 plots the ranges of capital and operational costs of the three defined classes of distributed desktop computing environments. The cost plots were developed by assuming a +/- 20% range in the cost values presented in the previous table. It also depicts the overlapping range of costs for the different client devices. In the next section, META Group will extrapolate this plot to graphically show how the real cost of ownership of network computer devices compares to managed and unmanaged PC/LAN devices, depending on the application and the percentage of networking the client device is doing in comparison to local processing.

Figure 7 — Capital and Operational Cost Plots in Different Environments



Analysis of the Study's Qualitative Findings

In this section of the report, we present the qualitative findings and analysis of the results of the essay and phone interview portions of the survey. More than half of the study was devoted to understanding the business drivers for, and the negatives and positives of, deploying network computer devices in corporations. The analysis in this section of the report is based almost exclusively upon these findings and the qualitative data collected.

I. The Need To Control Costs Is Driving Architectural Change

Network computing represents a basic shift in how organizations think about and deliver their next generations of Web-based and/or networked applications. A network computing architecture centralizes control of software and data at the server and allows for a spectrum of client hardware from terminal like devices to full function personal computers. Network computer devices offer an alternative to the desktop PC in specific application environments. Network computer devices give these IT departments a cost-effective way to control, manage, and operate desktop computing platforms in selected application areas.

Every organization participating in this study told us that they currently deplete significant resources, time, and money in maintaining their disparate desktop systems. Part of their problem stems from a lack of standardization of desktop hardware and operating systems. Consequently, administration and management of these environments is expensive, complicated, and time-consuming. Continuous investments must be made in new desktop hardware, software upgrades, and maintenance to support evolving application and network resource requirements.

The capital costs of network computer devices may not be significantly less than those of PCs, but for specific applications and classes of users they can be much easier to support for a variety of reasons. PCs contain more hardware components, more complex software, more complex user interface features, and more operating system components than network computer devices.

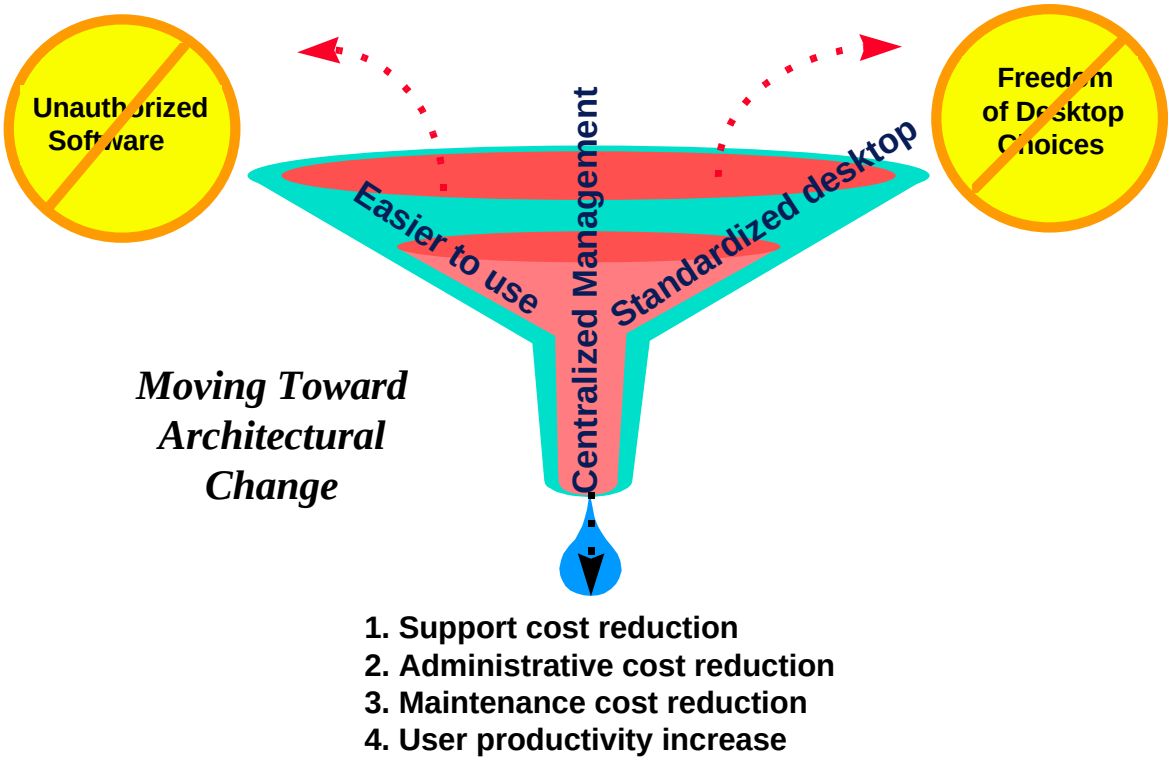
What follows are some of the specific issues that emerged from the META Group user interviews.

- The complexity of PCs makes them more prone to trouble due either to user errors or to real hardware or software problems.
- PCs have to be individually configured, and this is often done at the desk. Consequently, unmanaged PCs often require more technical support than dumb terminals or network computer devices.
- Users often try to solve technical problems themselves or seek help from other workers, which sometimes exacerbates the problems and always siphons off time from their real jobs. Only a fraction of problems are ever reported to the corporate help desk.
- Users almost always first seek the advice of the nearest colleague that seems to know something about troubleshooting the PC or using the software. The loss of productivity and extra problems these users cause can cost the company close to double the amount of

time to support and correct the problems, not to mention the loss in worker productivity while the employees are trying to fix the problem on their own. All of these efforts contribute to the escalating "shadow-IT costs" within organizations.

As a result, to obtain all the benefits of network computer devices, PC users must be willing to give up their freedom to use the desktop device of their choosing or their ability to run any software they choose (see figure 8).

Figure 8 — Network Computer Devices Represent Architectural Changes



The respondents also made mention of the following additional observations.

- Network computer devices are primarily designed to save administrative, support, and maintenance costs over time.
- The entire network computer device can be easily swapped out for newer models because, unlike PCs, network computer devices do not store information persistently. This means that user data, preferences, and profiles are stored on a server where they can be easily retrieved and downloaded each time a particular user signs onto the network. There are no disks and user files to remove and replace when the boxes are swapped out.

- Thin clients will not make PCs obsolete any more than PCs made mainframes obsolete. PCs will still remain the dominant architecture in the majority of companies during the next five years.
- Network computer devices are just one more computing option for IT managers. Nevertheless, fundamental changes in the use of applications and access to data is imminent because of the cost pressures currently facing virtually all IT managers that we interviewed. Consequently, we expect all organizations to make some type of IT policy and system management changes within the next 12 months to address their companies' cost-of-ownership issues. Network computing with a variety of client choices is one element in an IT manger's arsenal of solutions.
- The scope of these changes will affect everything from utilization of automated management tools to centralizing control over client-side computing, and moving application processing to the server. However, changes in IT management policies can have a significant impact in reducing a company's computer costs and liberating technology resources for other projects. Implementing these practices can also have a negative impact on end-user computing flexibility. IT must work with line-of-business units to determine the appropriate mix of management control and end-user flexibility.
- All networking computing devices will decrease in cost by roughly 30% from a total cost of ownership standpoint over through 2001 and the difference in cost between network computing devices and managed PC's will narrow.

Analysis of the respondents issues and observations indicates a clear desire on the part of IT managers to reduce complexity of desktop systems that must be managed. It also allows IT to centrally manage and control desktop systems to reduce costs.

META Group believes that companies are deploying network computer devices as a way to obtain zero administration clients. However, if we believe a key to solving users needs in this area centers as much on corporate policies and software architecture than on any particular hardware device on the desktop. Benefits, such as centralized administration of the desktop or locking down PCs, can be derived from the discipline that is automatically imposed by network computer devices. Unlike the network computer devices which automatically imposes a method of centralized control, IT managers need to force a similar discipline to establish this level of cost control.

Hidden IT Costs in a Pure Network Computer Device Environment

It is important to note that any radical departure from the current desktop platform in an organization could have significant application development, systems integration, and migration costs above and beyond the standard capital and operational steady-state costs. Many of these costs will be attributed to the startup costs directly associated with migrating to any new platform. This study examines only the steady-state costs of the platform and does not attempt to measure or ascertain this initial increase in costs.

The proper use of a network computing architecture deployed with appropriate applications can significantly impact current client-related IT costs. Changing the desktop architecture to devices that are easier to support and manage within the organization can effectively reduce overall IT support costs. However, the chosen device and the infrastructure already in place to support that device will largely determine the overall cost savings to the company. META Group concludes that any savings on the desktop, such as those that are derived from moving from a fully loaded PC to a network computer device, may be offset by increased costs for networks and servers, if these technologies are not adequate to support the migration to network computer devices. Pure network computing environments require larger servers with more CPU power, memory, and disk space than LAN-based environments. Networking equipment such as hubs, routers, and switches must be upgraded to accommodate increased traffic. And systems management costs on the-back end server and the network will increase with the growing network availability demands for fault tolerance, backup/restore, and system monitoring, regardless of the type of client device.

Companies will be able to reduce their costs and increase user productivity by matching the appropriate computing device to each worker's job requirements and computer skills. IT managers must realize that PCs and network computer devices do not necessarily add up to an either-or choice. Currently, neither type of device is a panacea for all computing needs. Not only is there a place for both desktop systems in almost any organization, it is also possible for a company to deploy network computer devices without abandoning all its PCs. Network computer devices can and will peacefully coexist on the same networks with PCs and mainframes. Both types of desktop devices can access the same data and run the same networked software. And both devices excel at different tasks.

Network computer devices are good choices for focused operational application users, lightweight office application users, and certain classes of remote users that are difficult to support. Network computers are being deployed in locations where users are working on field applications or access only a limited number of applications as part of their job descriptions. Personal computers are good choices for general-purpose office users, knowledge workers, analysts, heavy office automation users, and anyone with highly variable needs or a mobile requirement. .

IT Costs in a Managed PC Environment

META Group believes IT organizations will aggressively implement some level of cost reduction strategy over the next two to three years. By 2001, 70%-80% of all large IT shops will be considered highly managed by current standards. IT managers should note that simply locking down the client for more than half the users in a company will achieve a significant overall cost reduction.

Support for repair of desktop devices or for software or hardware installation and updates are the two cost components that will see the most dramatic improvement by moving to network computer devices. The number of calls to the help desk decreases dramatically due to a lack of software and hardware conflicts. In addition, more calls can be answered at the Level 1 help desk. This reduces the need to escalate the problem to field personnel and eliminates the need to manually go out to every site to effect repairs.

The participants of this study all indicated their expectations of major cost reduction in support and maintenance of desktop systems when they move to network computer devices. They expected to reduce the cost of software support and distribution by moving to centralized administration and network computer devices. META Group believes this reduction could amount to 10%-15% as opposed to poorly managed PCs. Approximate savings can be realized with other types of network computing devices including managed PCs.

However, while IT managers who participated in this study believe network computers would provide IT benefits, most departments or individual business units are reluctant to relinquish their own computing flexibility. Many LOB decision-makers insist that they will not voluntarily give up their disk drives or PCs. For technical and psychological reasons, when users are given a choice they will almost always choose to have a PC.

META Group believes the huge protective instinct of LOBs and their users' unwillingness to relinquish their desktop PCs should dissuade IT managers from attempting to mandate these decisions in decentralized organizations. Instead, IT managers should apply a management discipline to the PC environment and act as an internal consultant on platform selection. We believe that IT managers should measure various alternatives such as network computer devices, managed PC devices, and unmanaged PC devices, against their corresponding benefits and associated support costs. IT managers should also allow the LOB units to determine the organization's ultimate course of action based on their willingness to spend money in return for a perceived benefit from the technology. IT managers can pass along increased support costs to departments or users that do not want to give up any personal control of their desktop or who cannot move to less costly devices because of their job requirements. At the same time, IT departments that can substantially reduce their support costs can also pass these savings along to departments that do lower cost devices in the form of lower per-user support costs. IT can therefore encourage users to migrate to network computer devices and managed PCs rather than impose or dictate policy -- particularly for decentralized organizations.

The following specific example of this practice is drawn from one respondent case study which illustrates how one IT department expects to accomplish its goal of migrating its departmental users to network computer devices. In this organization, every department has a specific IT budget and pays for its support, maintenance, service, and upgrades for each PC. The company charges each department a fixed fee per PC for this service. The IT department has calculated that moving to network computer devices will simplify its requirement to have to support and maintain hundreds of different software and hardware configurations. Consequently, the IT department's own support costs will be reduced substantially. To encourage each department's migration to a new, thin-client standardized desktop device, the IT department has decided to pass along the cost savings to the departments. If a department moves to network computer devices, the cost per user will drop from $90 to $40. However, if the department wants to keep its PCs or cannot move to network computer devices, the department will be charged $250 per user for the PC. Since each department is responsible for its own profitability, the IT manager believes the move to network computer devices will now occur more rapidly than had originally been predicted. This same approach can, and should be used to determine the cost of managed PCs and provide lower support costs to the departments that are willing to relinquish some control but who need to retain PC flexibility.

II. NETWORK COMPUTER DEVICE MARKET OPPORTUNITIES: GENERAL ASSUMPTIONS

The key to achieving RCO savings with network computer devices is knowing where they can be best utilized — and where they can't. The next section, *Best-Fit Applications and Environments,* describes the opportunities in more detail. To many IT managers, network computer devices cannot do the same type of work as its PCs. Some organizations are not ready or able to port desktop-based applications to servers. And there are applications such as data manipulation and calculations or extensive personal productivity office applications that need to be processed locally. And there are many problems associated with network computer devices that can stop a business that depends exclusively on them dead in its tracks (see the section titled *Downsides of Network Computer Devices*). For these companies or departments, network computer devices are not acceptable alternatives in most cases therefore, PCs or workstations will continue to be the desktop solution of choice.

III. BEST-FIT APPLICATIONS AND ENVIRONMENTS FOR NETWORK COMPUTER DEVICES

And the majority of respondents indicated that the primary commercial volume opportunity for network computer devices is in the terminal replacement market. This is the easiest and best fit for the diskless device, because the applications in most instances already reside on the server and do not have to be rewritten or re-hosted. Study results indicated that this is where volume shipments are initially occurring. The terminal replacement market is also a natural fit for the centrally managed PC or zero administration client as well.

Based on the maturity of applications and technology, network computer devices work best in the specific areas or applications listed below.

- Replacement for text-based dumb terminals
- Highly specific and network-centric data access
- Fixed field or limited number of applications
- Shared desktops

Replacements for Text-Based Dumb or X Terminals

The most natural fit for network computer devices lies in their ability to easily replace dumb or X terminals. There are 30 million to 50 million IBM 3270 and 5250 terminals, VT-series terminals, and similar ASCII/ANSI dumb terminal devices installed worldwide. The network computer devices are able to easily run the same legacy programs and access the same data that ran on the dumb terminals. A major advantage of network computer devices over a dumb terminal is that they offer a browser-based interface to enable users to access the Internet and corporate intranets. Users of network computer devices are no longer restricted to text-only applications. With these thin clients, users can also view and process graphical data or images — something they couldn't do on text-based screens. Classic applications that were run on these environments were reservation systems, order entry, financial services, retail, package and goods tracking, etc.

Highly Specific and Network-Centric Data Access

Network computer devices are ideal for any employee whose job requires accessing data in a centralized database and filling in electronic forms. The network computer client is well suited for applications that involve processing reservations, order entry, or obtaining parts lists, catalog items, or schematics from a centralized database.

Fixed Field or Limited Number of Applications

Network computers easily fit into areas where dumb terminals reigned for years — running one or two key applications or applications with fixed data fields that are only available on the server. The applications best suited for this classification involve users who are low-level order-entry employees or high-level executives. Neither of these two groups of users spends time processing its own data spreadsheets or performing disk-intensive processing.

Shared Desktops

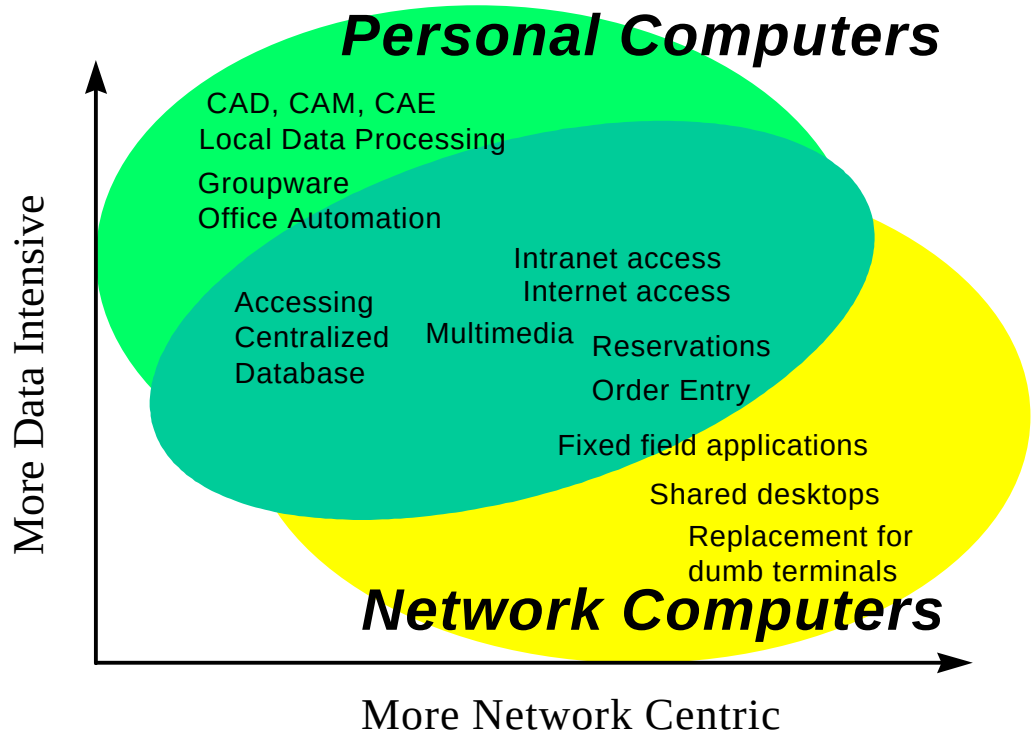
Network computer devices also fit into the workplace for around-the-clock employees sharing a desktop device, part-time employees, independent contractors, temporary workers, and those who work at sites away from the corporate office. There is very little justification for a company to provide a full-function PC for every employee who might need the use of a computer at the office. Network computer devices are stateless so each employee can download their own personalized working environment upon logging into the server. The system can be easily shared by more than one user. The applications most suited to running on shared desktops include any around-the-clock activity: order tracking, order processing, parts ordering, claims processing, reservations systems, and support desks, etc.

IV. HOW RCO AND NETWORKED PROCESSING AFFECT APPLICATION COST

Figure 9 depicts how the real cost of ownership of network computer devices will shift, depending on the degree to which the device is networked and the degree to which the data needs to be processed on local storage. The lowest RCO values are derived from devices running applications that are 100% networked and that have no local processing requirements. Because each application is slightly unique and depends on the environment in which it is running, META Group has approximated an “average” relationship of one application to another. The same application in two different companies might actually be plotted slightly differently, depending on how the organization processes its applications and data.

The lowest cost of ownership can be achieved by using network computer devices as replacements for dumb terminals and shared desktops. Low RCO costs are also possible for network computer devices running fixed field applications and order-entry processing. Personal computers are better choices for running CAD, CAM, CAE applications, for carrying outing local database processing, or for doing complex graphics and image processing.

Figure 9— Some Market and Application Opportunities for Network Computers & PCs



V. COMMON OBJECTIVES FOR NETWORK COMPUTER DEVICES

All the IT managers who agreed to be interviewed for this study shared the following common set of objectives for using and deploying network computer devices.

- Lower costs for administration and maintenance
- Increased security and integrity of the computing environment
- Increased communication among employees using the Internet or an intranet
- Interest in applications written in Java programming language

Lower Cost for Administration and Maintenance

A primary motivation of the survey participants for migrating their companies' desktops to network computer devices is better administration and manageability of multiple geographic locations or remote users. Desktop systems that are physically located apart from the main IT location are difficult and expensive to support and maintain according to the survey respondents. If a PC breaks down at a remote location, IT help desk personnel must try to talk the user through the process of repairing the system. If that fails, the IT department must dispatch someone to fix the problem on-site. When this involves tens of thousands of users, the costs of support are prohibitive. At $1,418 per user, (the survey-derived operational cost of support) management and training for 10,000 typical unmanaged PCs amounts to $14 million per year in operational costs

for the corporation. Moving to a network computer device instead could save the company more than $3 million a year in operational costs alone.

Corporations are beginning to purchase and install network computers devices, because the devices can dramatically lower total life-cycle costs over traditional feature-laden PCs. Because network computer clients lack extra features such as persistent storage, local configuration, and various other components, there are less components that can cause failure.

- Software patches or upgrades can be easily downloaded from the server.
- When there is no need to support multiple configurations of hardware and operating systems, software updates are much easier to do and less expensive to accomplish.
- In the case of a real hardware failure, the IT department can easily replace a stateless client with a new system because there is no local software, local configuration data, or data files to restore.

META Group believes, however, that many of these capabilities will also be available in the well managed PC environment in the next 2 years. Nonetheless, in terms of operational costs, the well managed PC may not have the same magnitude of cost savings as network computer devices.

Increased Security and Integrity of the Computing Environment

Security and preserving network integrity are two key advantages cited by the respondents of this survey for having a sealed case design. Unmanaged PCs can be security risks for corporations, because they store everything locally and provide users with virtually unrestricted access to strategic data in local storage. Network computer devices store everything on a server. Servers are more physically secure, provide better virus protection, prevent unauthorized installation of "private" software, and are backed up on a regular basis. Many of the respondent IT managers praise the sealed-case design, as their users will not be able to ruin the boxes or alter the settings.

The majority of the IT managers who participated in this survey agreed that one of the biggest problems in most large organizations stems from software that users bring to work with them on a floppy disk. Users often load their own applications or games that they bring from home thinking that this software is harmless. Unfortunately, all too often IT departments suddenly discover a rash of viruses or incompatibilities that can bring an internal network to its knees. Network computer devices without available local storage give IT the ability to stop employees from tampering with their systems.

Increased Communication Using the Internet or Intranet

Almost all the IT managers who were interviewed revealed plans to make better use of the Internet or corporate intranets to improve communication within the company and among employees and workgroups. With network computer devices able to access the Web, most survey respondents indicated that critical business applications now included access to human resources or corporate information, e-mail, and company directories, with internal discussion

groups becoming available to all employees. Nearly all companies surveyed plan on using their intranets and the network computer devices to make employees more productive through increased training and to make the company more productive by encouraging interactive online discussion groups. Network computer devices all have browser-based graphical user interfaces that can take advantage of this environment. Table 5 shows the major differences between a network computer device and today's unmanaged PC environment.

Table 5 — Summary of the Benefits of Network Computer Devices over PCs

Benefit	*Disadvantage of Today's Unmanaged PCs*	*Advantage of Network Computer Device Over Unmanaged PC*
Reduce Support Costs	Desktop systems that are physically located away from the main IT location are difficult and expensive to support and maintain because they must be manually serviced in the field when problems arise. Well managed PCs solve some of these problems but they don't solve all of the field support issues. PCs can't be centrally configured.	Offers one single and consistent architecture that can be centrally managed and supported from server across the network. Configuration data is maintained on the server not on the local device.
Reduce Maintenance Costs	Different PCs operating system versions and different hardware configurations make software updates difficult due to incompatibility issues. In case of failure, the users disk, data, and profiles must be restored if a new PC is required. Manual intervention on site is a frequent requirement.	Software is installed on the server. The same version is run by all network computer devices. There are fewer parts that can fail. IT department can easily replace a stateless client with a new system because there's no local software or data files to restore and box swap out is possible and cost effective
Reduce Security Risk	PCs store data locally. Users have unrestricted access to strategic data in local storage.	Network computer device has no local storage. Users access to sensitive data is restricted

Interest in Java Programming Language

There is a growing interest among many of the IT managers who participated in this study to rewrite existing, outdated applications or to create new, more interactive Web-based applications using Java. Companies of all sizes in this survey indicated that they are increasing their spending for Java development beyond just the development of Web pages. The attraction of a "write once and deploy everywhere" application is compelling to many of the respondent IT managers. It

speaks to the promise of reducing software porting and deployment costs. And for leading-edge companies, Java's shorter time to market and content-rich capability also provides the hope for a competitive edge in business. Companies are also interested in collaborative computing programs that extend corporate boundaries. The majority of the early adopters of all classes of network computer devices who participated in this study have Java software projects underway.

Another advantage of Java often cited by the respondents is that Java programs are decoupled from the operating system, CPU, and hardware. Everything below the Java virtual machine can theoretically change without having to recompile or change the applications. The Java programs link to server components, which can run Java applications or any other program on a server or a mainframe. This makes it possible for a user to run Windows, mainframe, and Unix applications on a Java-centric network computer device. All applications, even those not written in Java, execute on the server or mainframe and will eventually execute at native server speeds.

VI. DOWNSIDES OF NETWORK COMPUTER DEVICES

Unlike PCs, network computer devices depend on the availability of both the server and the network to function. Network computer devices are subject to a variety of types of failures that would not necessarily affect the performance of stand-alone PCs. Any one of these could bring a business that is completely dependent on network computer devices or locked-down PCs for all its processing to a halt.

- **Network failure** — Network outages, slowdowns, and reliability problems are the major concerns of network computer users, because a failure or performance problem with the server will bring a user's ability to do any work to an end. If this happens to a well-managed PC or PC environment, the user would lose access to e-mail, the Internet, and any server-based files. Local work would be able to continue as long as critical network-based applications did not need to be accessed.
- **Server failure** — Server failure presents a similar set of concerns to network failures by rendering network computers unusable in a typical networked environment. PCs can continue to process using local data and storage.
- **Phone-line failure** — This is a major problem for remote users who rely on telephone lines to gain access to the server and network. When the phone line is down, so is the remote user's ability to do any work.
- **Immaturity of Java** — Although Java is a fundamental technology for many of these devices, it is immature with limited application support. Future control and direction of the language is currently the topic of an intense battle between Microsoft and Sun.
- **Server and network outages** — have a significant impact on network computer devices

VII. WHERE NETWORK COMPUTER DEVICES DON'T BELONG

Network computer devices currently should not be used for some specific applications and in certain instances. Network computer devices are not well suited for graphic designers or artists who use CAD, CAE, or photo-processing software to design, scan, or edit images. Software developers who frequently install, edit, and test new software, programming tools, and utilities

need more local storage on their systems. Remote workers who rely on slow dial-up connections may or may not be able to use network computer devices. Their ability to use these devices depends on the types of network connection that are available or the type of applications they need to access.

In summary, network computer devices are not well suited for users that:

- Require large amounts of local processing power
- Are involved in application development projects requiring continual changes
- Execute applications that are available only on workstations or high-powered PCs
- Do not have access to a fast or responsive network
- Have a network that is bandwidth constrained
- Require heavy use of personal productivity applications.
- Require mobile or stand-alone operations

VIII. WHERE WELL-MANAGED PCS ARE A BETTER CHOICE THAN NETWORK PCS

Since the major attraction of network computer devices is manageability and zero administration costs, well-managed PCs and the implementation of better administrative tools and centralized management represent a real alternative to network computer devices. Well-managed PCs will be another workable means of controlling desktop computing costs. Well-managed PCs are more suitable for knowledge worker environments and users who must process information on local disks. Network computer devices without local storage will never be able to replace well-managed PCs in these environments.

META Group believes the PC market will adopt the application architecture concepts pioneered by network computer devices. The first phase of this adoption includes the model of the current well-managed PC. This will be followed by the future well-managed PC. Then, during the subsequent two to three years, software vendors will rewrite their programs around what META Group calls a “logical NC” model, with all application-state information configured at the server, but cached on the client for local execution.

The well-managed PC evolution will transition through three stages:

Stage 1 (2H97-1H98) — The current well-managed PC uses Windows NT Workstation to lock down the client environment along with heavy use of third-party automated management tools for software distribution, inventory, metering, and remote control/diagnostics. The well-managed PC environment also requires a relatively strict level of standardization among PC platforms and end-user configurations. Late 1998 it will also run Windows 98 or Windows NT version 5.

Stage 2 (2H98-2H99) — The future managed PC exploits advanced embedded management features derived from PC and NetPC technologies including: Wake-ON LAN technology, preboot service agents, ACPI, plug and play, and DMI 2.0. The PC will run Windows 98 or Windows NT Version 5. Managed PC environments in this stage will move away from discrete management of the client toward continuous configuration management.

Stage 3 (2000-01) — We expect this full-function "logical NC" to appear by 2000 and represent the merging of the PC and network computer devices into a single integrated spectrum of platforms with a single software architecture. The "logical NC" environment represents an implementation of a network-centric software architecture, including a shadow server to dynamically synchronize data and applications between the client and server. "Logical NC" clients include most of the same technologies of the network computing devices.

IX. NETWORK COMPUTER DEVICE POTENTIAL GROWTH PHASES

The early rollout of network computer devices have not been without problems. And according to the participants of this survey, problems from ease of installation to oversold hardware cost savings have plagued network computer devices from many of the leading vendors. Promises of plug-and-play network computing solutions proved not to be mature enough for early adopters of the technology. Promises of major cost savings for the network computer devices compared to the costs of a PC did not always prove to be true since the costs of some low end Pentium-based PCs were less expensive than some types of network computers with monitors.

Nevertheless, the concerns about buggy systems and early problems have not been enough to warn away many large companies. As the kinks were worked out, pilot projects increased in all the companies that were surveyed. All the respondent companies plan to continue their rollouts of network computer devices throughout 1998 and well into the future.

For the companies participating in this survey network computer devices provided a very effective way to reduce and control costs. Network computer devices help IT standardize on a single desktop computing model and reduce the number of configurations and versions of software and hardware it has to support within the organization. This was the major reason cited by every company META Group surveyed for moving to this device. Consequently, although the migration may not have always been easy, the IT senior staff at almost all the respondent companies are pleased enough to begin early deployment. Many of the major vendors report that they have been shipping network computer devices in volume for the last few months.

There are several scenarios for how network computer devices will be adopted that were obtained from the qualitative data of this study. There is also future opportunity for these devices in other markets, particularly in the context of the Internet. However, these areas will take more time to mature and will require more available applications before there are any volume shipments. The market for network computer devices after the year 2001 will emerge as an alternative form factor for networking computing as a whole.

META Group believes there will be three phases in the evolution and adoption of network computer devices: Evaluation and Pilot (1997-1999), Early Adoption and Deployment Phase (1998-1999), and Integration and Growth Phase (2000-2001).

Evaluation and Pilot Phase —Companies are pilot testing these products in their organizations. In many cases, more than one vendor's product and/or different classes of device are being tested. Companies we surveyed plan to take from six months to two years to deploy these devices throughout their organizations. We believe this will be representative of a general trend

throughout most Global 2000 companies planning an addition of network computer devices to the desktop mix.

Early Adoption and Deployment Phase —Through 1999, the bleeding and leading edge companies will begin to deploy network computers in limited application areas in their companies on a large scale basis. We expect companies to begin using and deploying different classes of network computer devices as selected applications are ported to servers and as new server based applications are developed. These systems will then move from bleeding edge to adoption for selected corporate environments.

Integration and Growth Phase — Maturity of the intranet and the networked applications market coupled with experience that users will gain and demonstrated cost savings will accelerate the user of network computers for specific applications. By 2001 network computer device use will grow as they evolve from an architecture that competes with PCs into a hybrid of a "logical NC" architecture in which PC's and network computer devices represent alternative form factors exploiting a networking computing software architecture.

Survey Responses and Analysis

This section summarizes the combined survey responses obtained from both client interviews and completed surveys sent to META Group (see Appendix A for the actual survey questionnaire). Not all IT managers were able to entirely complete every section in the survey. In some companies, the data was either unavailable, unobtainable, or unknown. Most companies have refused to grant META Group permission to publish their numbers as standalone case study figures. For these reasons, the consolidated data is presented graphically and textually. In the few cases where the META Group used additional primary research, the results are clearly identified as META Group data and not survey data.

I. DESKTOP CLIENT MIX DATA

In this section of the survey, participants were asked to describe the current mix of client systems in their organization and to indicate how it will change in the coming 12-18 months. Survey respondents indicated dumb terminals would decline from 18% to 7%, and network computer devices would increase from 1% to 8% within 18 months. This increase in network computer devices is important, because the majority of respondents were still in evaluation or pilot phases. Windows NT will increase from 8% to 29% and Macintoshes will be phased out of most organizations. DOS and older versions of Windows are expected to be phased out as well. Figures 10 and 11 illustrate these results.

Figure 10 — Mix of Client Desktop Operating Systems in Use Today

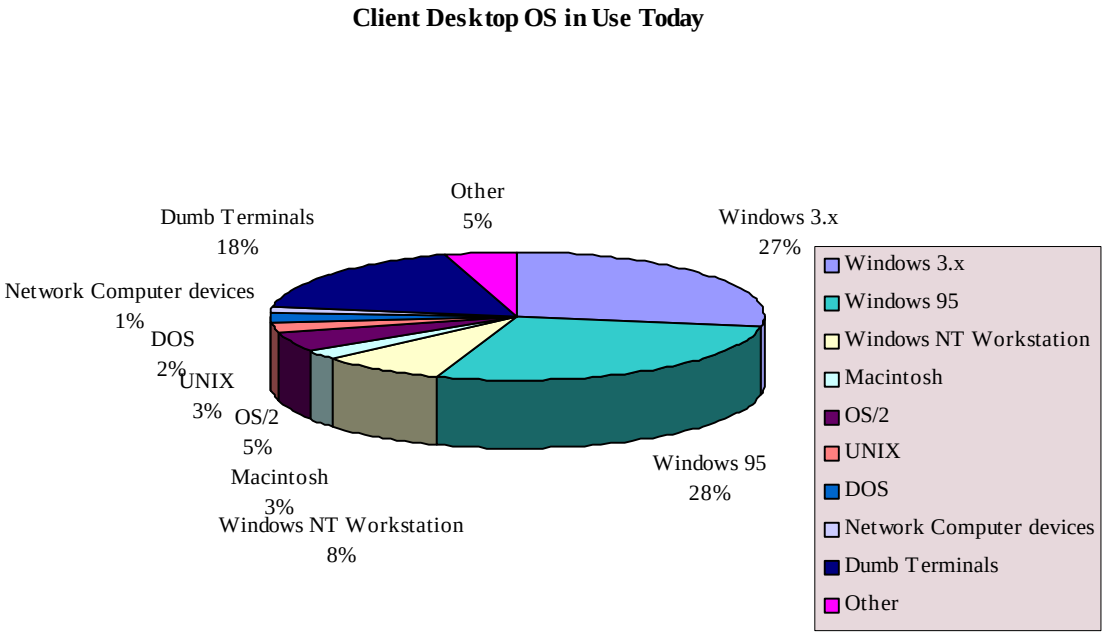
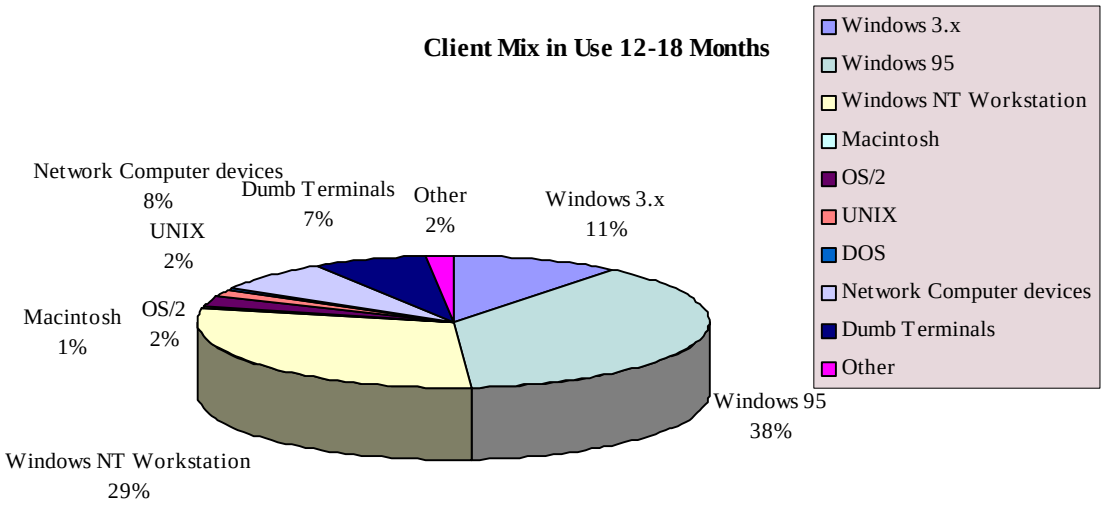


Figure 11 — Mix of Client Desktop Operating Systems in Use in 12-18 Months



II. WINDOWS-BASED PC CPU MIX

Survey participants were asked to identify the current mix of Windows-based PC CPUs installed in their target environments. They were also asked to indicate how this will change in the coming 18 months. The results confirm that companies are planning to eliminate the older, slower processors such as Intel 286 and 386 in favor of Pentium-class chips. Pentium Pro processors will have the largest projected growth, growing from 8% currently to 38% in 18 months. Figures 12 and 13 delineate these changes. The respondents indicated that as their companies plan or need to phase out their older computers, network computer devices are being evaluated as a viable alternative to PCs.

Figure 12 — Mix of CPU Type in Use Today

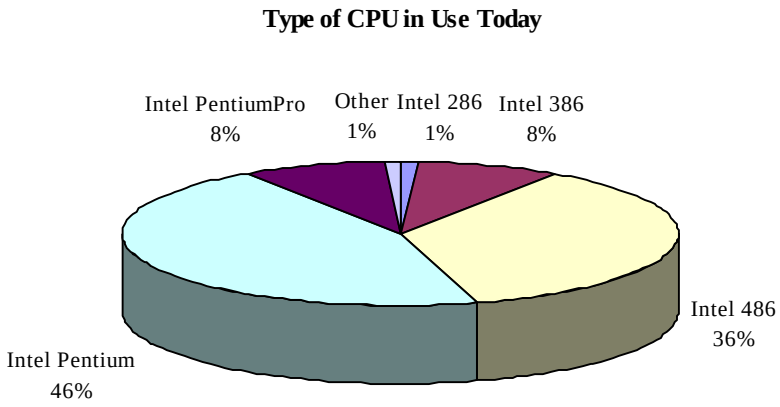
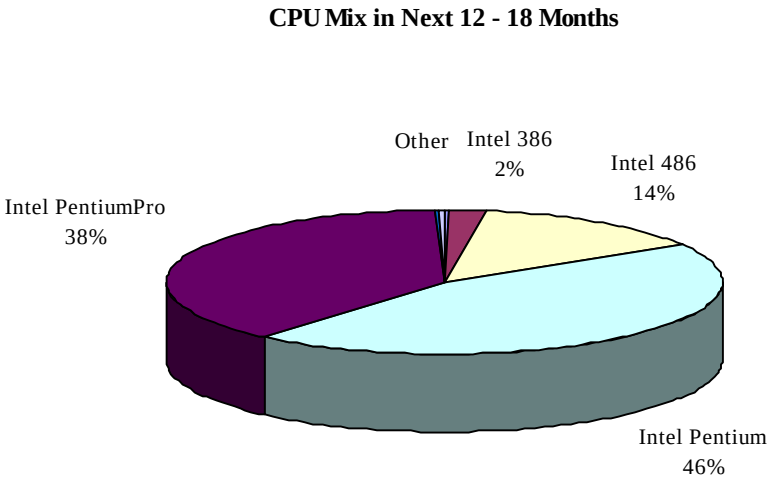


Figure 13 — Mix of CPU Type in Use in 12-18 Months



III. SERVER OPERATING SYSTEM MIX

In this section of the questionnaire, META Group asked participants to describe their mix of server operating systems as well as the number of users supported by each server. We also asked them to indicate how they expected this to change in the coming 12-18 months. Figures 14 and 15 represent the mix of server operating systems now and in the future. The purpose behind asking this question was to determine the degree to which the current infrastructure could support network computer devices. We wanted to determine how many servers would need to be upgraded as a direct result of moving to network computer devices.

Respondent companies were either not far enough into their evaluation to know this information or were able to support more users with their existing servers than they had anticipated. Nevertheless, the respondents indicated that their servers running older versions of NetWare and Vines would be replaced by Windows NT predominantly. Unix, OS/400, and MVS servers would essentially remain unchanged. We also began to see the expectation of moving to Java in small numbers. META Group expects that companies will need to increase their server capacity and performance if they are planning to move to either network computer devices or well-managed PCs.

The current number of users supported by servers and future expectations are consistent with the migration to Windows NT servers. In 18 months, the respondents indicated that they expect their Windows NT servers to support more than twice the percentage of users that are supported currently. We also observed a rise in the percentage of users that would be supported by Java servers, from less than 1% currently to 4% in the coming 18 months. Figures 16 and 17 represent the percentage of users that are supported currently and that will be supported in a year and a half.

Figure 14 — Mix of Server Operating Systems in Use Today

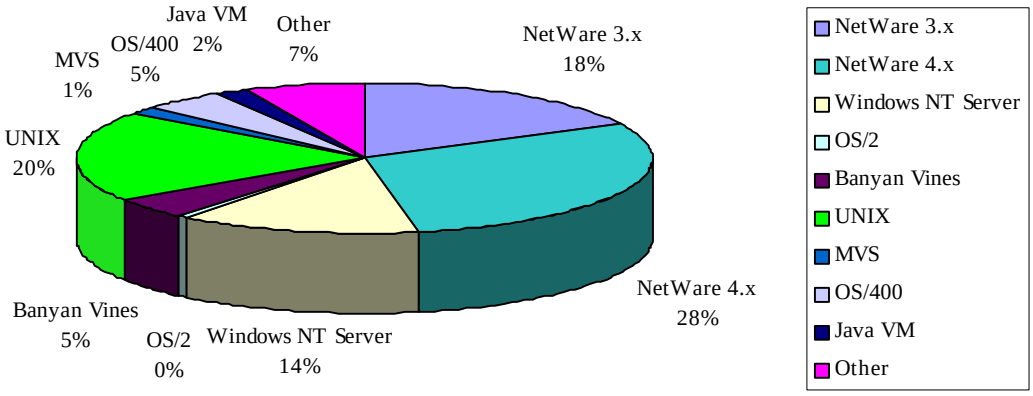


Figure 15 — Mix of Server Operating Systems in Use in 12-18 Months

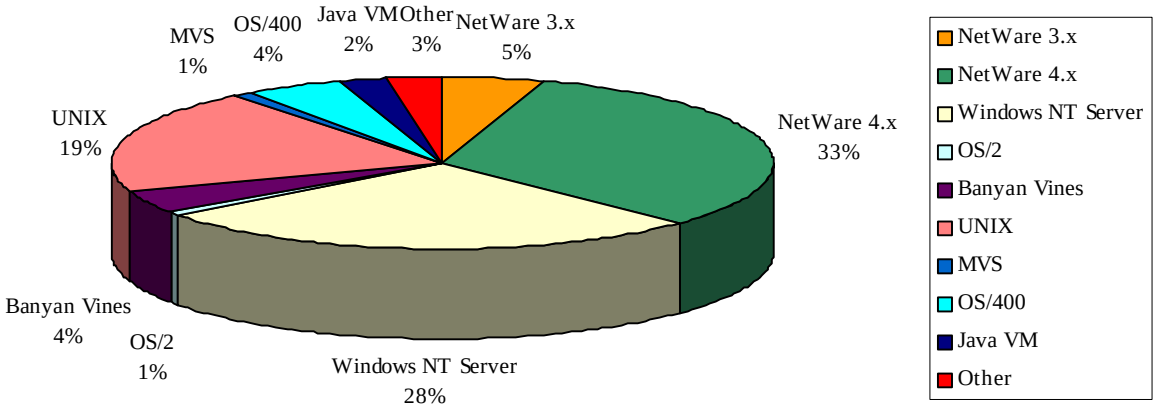


Figure 16 — Percent of Users Per Server Today

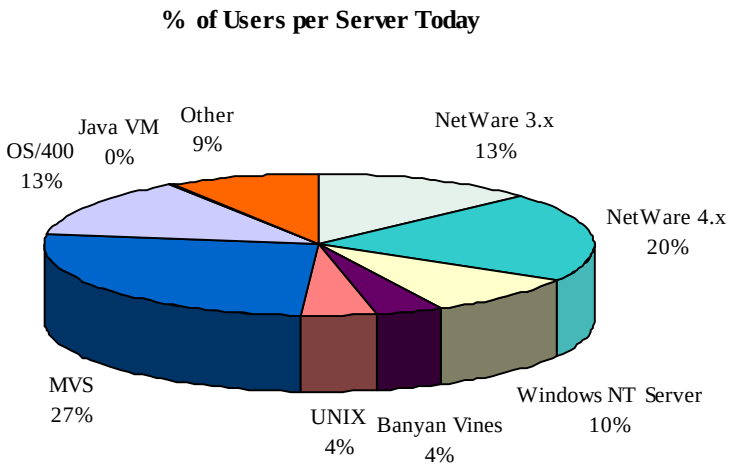
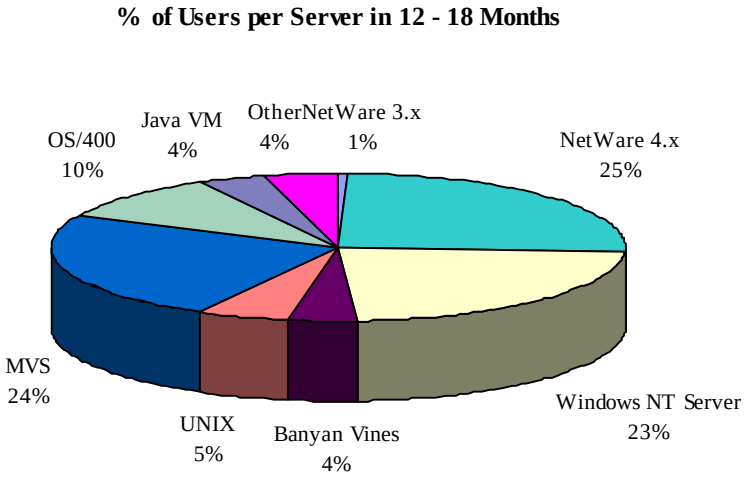


Figure 17 — Percent of Users Per Server in 12-18 Months



IV. MIX BY PERCENT OF LAN TECHNOLOGY

Survey respondents were asked to indicate the percentage mix of clients to servers or to the desktop LAN technologies that are installed currently and planned for installation in the next 12 to 18 months. We also asked the respondents about the overall performance and availability of their campus network infrastructure. We wanted to learn how many companies would be able to support network computer devices using their existing network infrastructure and how many would need to invest in additional upgrades. Less than 5% of all respondents believed their networks were subject to brownouts or could not support increased network traffic. The reason for this response was that most companies had recently installed or had begun installing more robust network technologies in preparation for increased Internet or intranet communication. One respondent indicated that the company would be moving most of its desktops to network computer devices in the next three years to all but one location where newer technology could not be installed cost effectively. The company planned on moving to a new site, rather than trying to retrofit the building.

Respondents indicated that switched Ethernet and switched Fast Ethernet were in their future LAN upgrade plans. In addition, terminal host connections, ATM, and token ring would begin to be phased out.

Figure 18 — Mix of PC/LAN Technology in Use Today

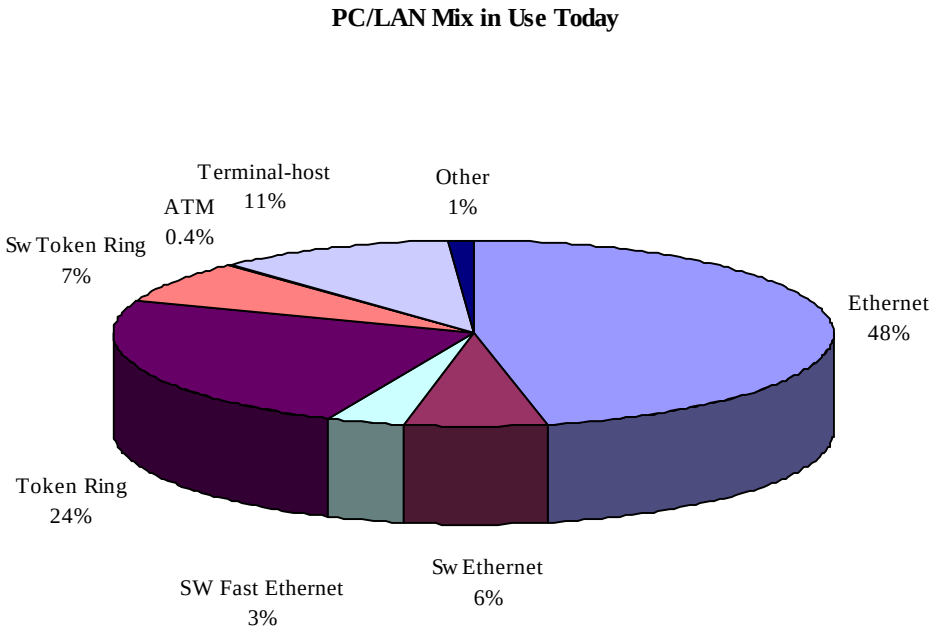
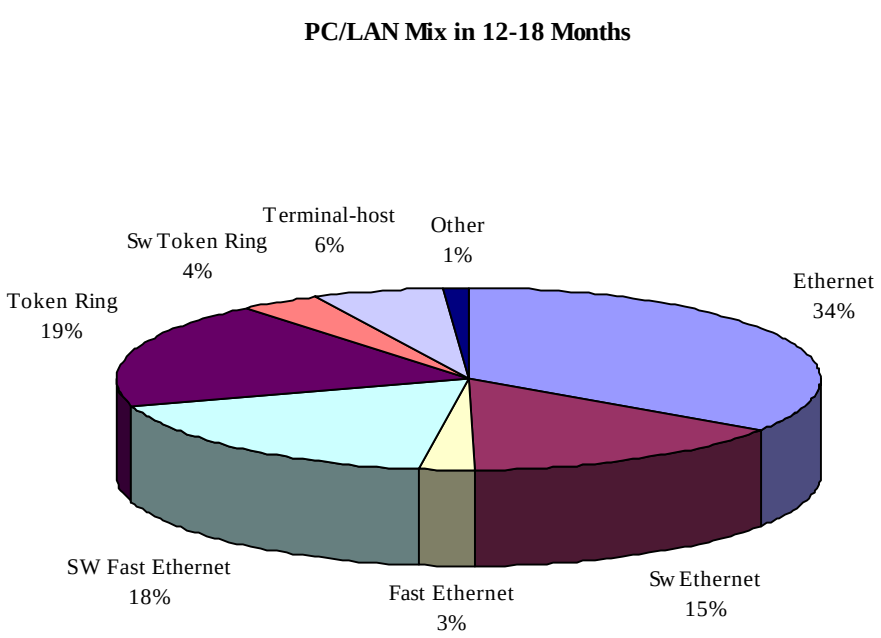


Figure 19 — Mix of PC/LAN Technology in Use in 12-18 Months



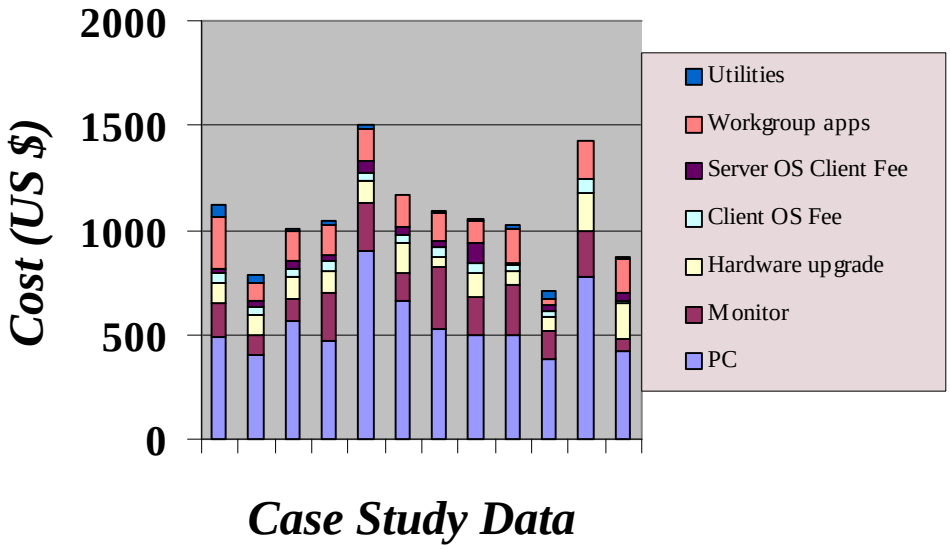
V. TYPICAL UNMANAGED PC/LAN ENVIRONMENT COSTS

Table 6 contains the combination of all the pure PC survey results that META Group used to obtain the cost data for the client in a typical unmanaged PC/LAN environment. Nonbold, italicized numbers were not provided by the client. In these cases, META Group used the average value from other case studies and its own primary research to generate a complete profile for this analysis. According to the respondents, their average cost for PCs is $1,066. Figure 20 is a bar chart detailing these same costs.

Table 6 — PC/LAN Environment Cost Calculations (in Dollars)

PC Cost Component	*Avg. of Sets*	*Set 2*	*Set 3*	*Set 4*	*Set 5*	*Set 6*	*Set 7*	*Set 8*	*Set 9*	*Set 10*	*Set 11*	*Set 12*
PC Hardware	**$548**	**489**	**400**	**567**	**467**	**660**	**525**	**500**	**500**	**380**	**773**	**419**
Monitor	**$175**	**166**	**100**	**100**	**233**	**139**	**300**	**183**	**233**	**140**	**218**	**60**
Hardware upgrade	**106**	**93**	**90**	**106**	*106*	*140*	**50**	*106*	**67**	**60**	**183**	**167**
Client OS Fee	**41**	**47**	*41*	**41**	*41*	*41*	*41*	**50**	**33**	**33**	**66**	**16**
Server OS client fee	**36**	**23**	**30**	**361**	*35*	**35**	**35**	**100**	**8**	**25**	**5**	**35**
Workgroup Application	**141**	**245**	**90**	**41**	*141*	**150**	**133**	**100**	**167**	**33**	**180**	**167**
Utilities	**19**	**52**	**30**	**19**	*19*	**3**	**7**	**15**	**15**	**33**	**3**	**3**
Total Cost	**1066**	**1115**	**761**	**1009**	**1042**	**1168**	**1091**	**1055**	**1023**	**705**	**1429**	**867**

Figure 20 — PC/LAN Client Capital Costs from Pure PC Respondent Data



VI. TYPICAL UNMANAGED PC/LAN SERVER COSTS

Table 7 reflects the combination of all the pure PC survey results that META Group used to obtain server cost data for clients in a typical unmanaged PC/LAN environment. Once again, META Group used the average value from other case studies and its own primary research to generate a complete profile for this analysis. The average server cost for respondents is $144 per client per year.

Table 7 — Typical PC/LAN Environment Server Costs from Sampled Data

Cost Component	*Average of all Sets*	*Set 1*	*Set 2*	*Set 3*	*Set 4*	*Set 5*	*Set 6*
Number of PC Clients	2940	4000	236	3914	1105	3947	4436
Price for Server	$1,093,431	$1,352,250	$150,000	$2,125,000	$847,000	$1,321,333	$765,000
Refresh Rate (years)	4	3	3	3	3	5	5
Annual Cost per Client	$144	$113	$212	$181	$256	$67	$34

VII. NETWORK COMPUTER DEVICE SPECIFIC INFORMATION

The following sections of the questionnaire asked participants to describe the types of network computer devices that they were deploying or evaluating throughout their organizations. The benefits, business drivers, and qualitative findings of this study were obtained from this section of the survey. The largest deployment of network computers in a given pilot group was 1,000 devices. The smallest pilot involved only 12. Most companies had at least 50-150 systems in their evaluation projects.

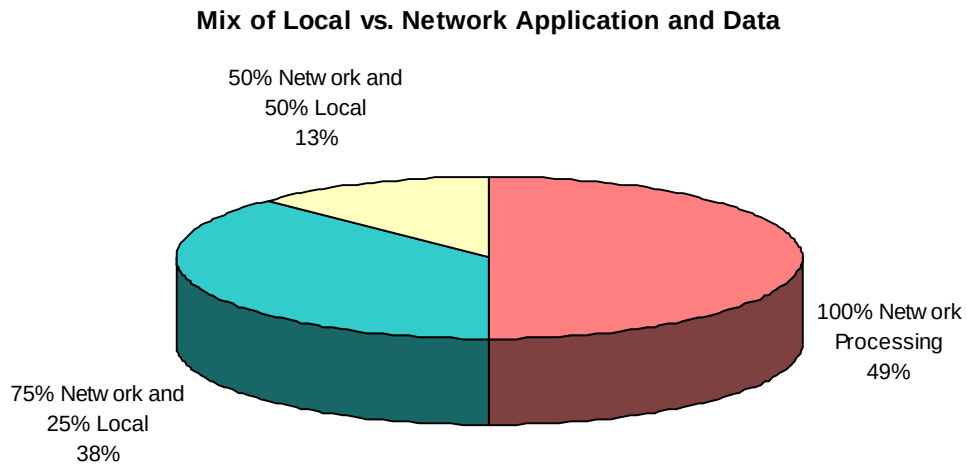
Of all classifications of network computer devices being evaluated, host terminal replacement devices constituted the greatest majority. Several factors account for this. These systems have been available and shipping longer than any other class of network computer device. In addition, these devices are good candidates for dumb terminal replacement. Finally, for many organizations in this survey, these devices are easy to install and integrate with a minimal amount of effort or upgrading.

VIII. THE CONFIGURATION IN WHICH THE NETWORK COMPUTER DEVICE WILL BE RUN

Half of the IT managers expected network computers to do 100% of application and data processing on the network. However, the other half that knew the answer to this question expected some degree of local processing to occur on the network computer devices in their organization. The reasons for this were as complex as the applications that were being

processed. For instance, one company needed the device to locally store data should the mainframe or network fail. Another company expected to process multimedia data, and needed images to be stored and processed locally. Figure 21 shows the breakout of networked and local processing expectations of the network computer devices in different companies.

Figure 21 — Mix of Networked and Local Processing of Applications and Data

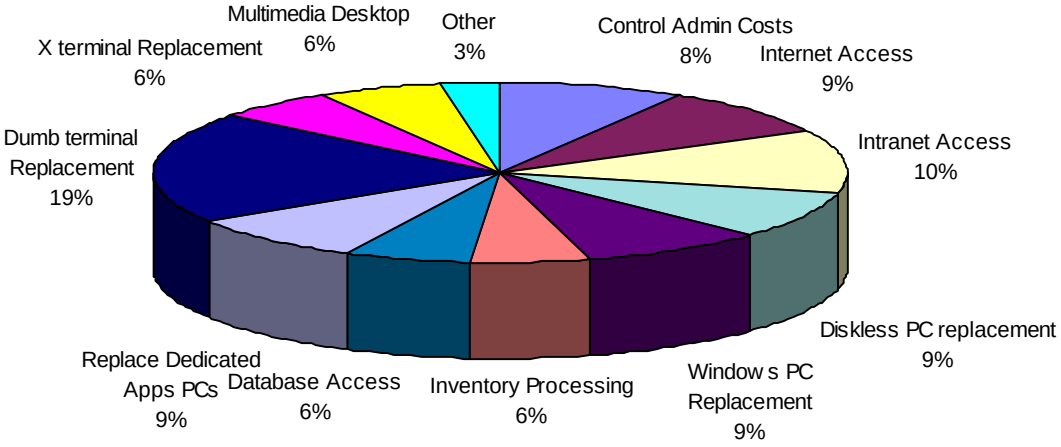


IX. THE ROLE OF NETWORK COMPUTER DEVICES IN ORGANIZATIONS

Network computer devices are being used to execute many applications that would be classified as mission-critical in the organizations we surveyed. IT managers were asked to choose from a list of applications and to identify all those that best describe the role of the network computer devices in their organizations. Figure 22 delineates the various ways in which the network computer devices are being used as desktop devices. The respondents were able to choose from more than one application choice.

According to the survey results, dumb terminal replacement was by far the largest role within all organizations for network computer devices. The second largest segment was for Internet and intranet access.

Figure 22 — Major Role for Network Computer Devices within an Organization



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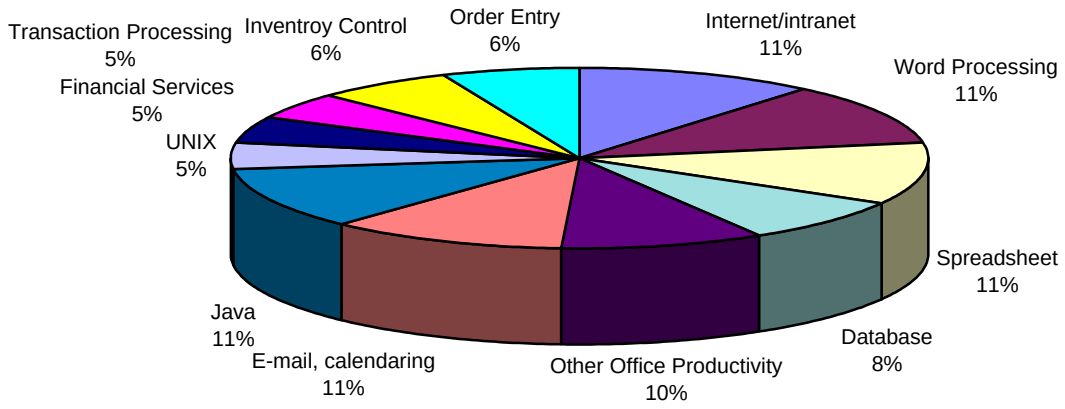
X. APPLICATIONS TO BE RUN ON THE NETWORK COMPUTER DEVICES

IS managers were asked to select from a list of applications and choose all the applications that best describe how the network computer device would be utilized within the organization. There were few applications that could not be run on the network computer devices. The respondents said that their main constraint for using a network computer device was whether the application they needed to run had been ported to a server or whether it required a large amount of local storage. Database and spreadsheet applications were usually consigned to run on a PC.

Network computer devices are being used to execute many applications that would be classified as mission-critical in the organizations we surveyed. The largest percentage of applications run by the majority of companies that we surveyed were all the major office productivity applications and Internet and intranet access. Figure 23 depicts the majority of the types of applications that were being run in the Global 2000 companies using or evaluating network computer devices. The total percentages exceed 100%, because IT managers were allowed to select more than one type.

Figure 23— Application Mix for Network Computer Devices

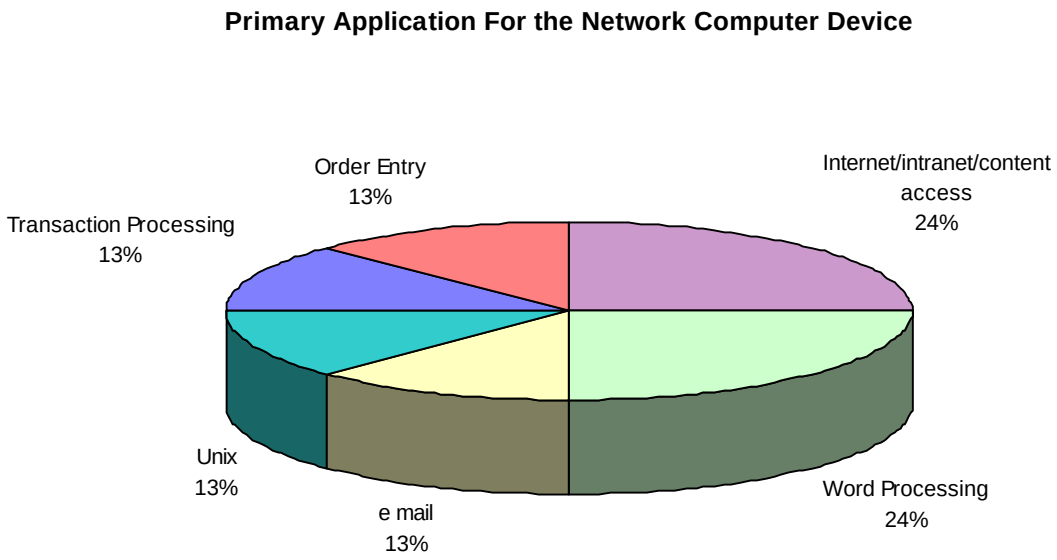


XI. THE PRIMARY APPLICATION THAT WILL BE RUN ON THE NETWORK COMPUTER DEVICES

IT managers were asked to name the primary application to be run on network computer devices. The largest percentage of applications run by most companies that we surveyed were major office productivity applications and those for Internet and intranet access. Figure 24 illustrates the majority of the types of applications that were being run in the Global 2000 companies using or evaluating network computer devices.

Selecting a single application that was more important than any other was difficult for many IT managers. Many commented that it was hard for them to rate the relative importance of word processing, calendaring, and other productivity applications in most instances. When pressed by META Group to select only the best answer, they chose word processing or Internet and intranet access in most cases.

Figure 24 — The Primary Application for Network Computer Devices

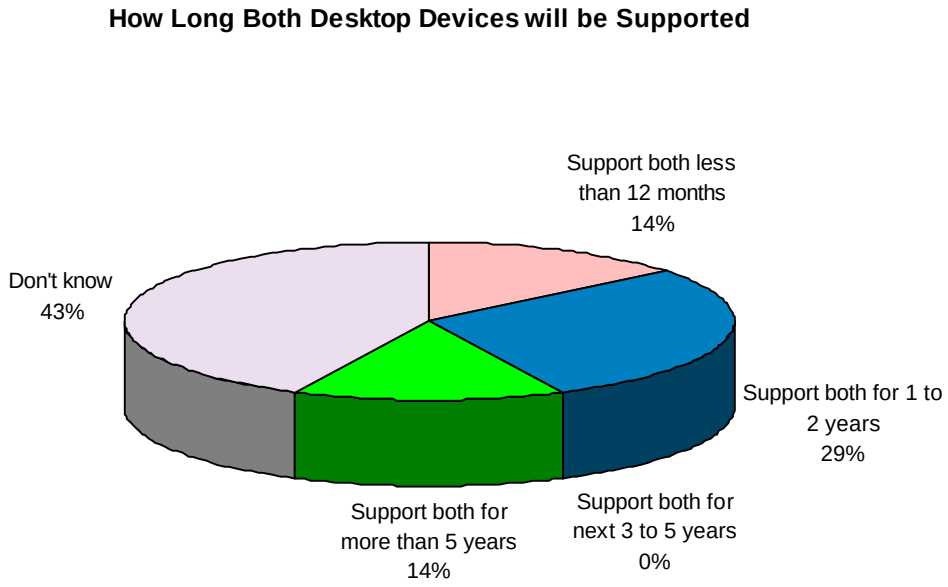


XII. THE LENGTH OF TIME THE COMPANY PLANS TO SUPPORT DUAL ENVIRONMENTS

Several companies plan to support dual network computer devices and Windows-based PCs, giving their users access to both types of systems. In this situation, the same user would access both devices to run different applications. Supporting two different desktop devices per user clearly implies a situation of increased costs. Not only does the organization have to pay for two different desktop systems, but they have to support the systems as well. It also indicates that the network computer device may not be capable of running the different types of applications or data processing that the organization needs. This will have a direct impact on the company's short-term real cost of ownership. The IT managers who expected to have to support dual desktop systems did affirm that these costs would be part of the incremental startup fees, rather than a permanent or steady-state cost for network computer devices. However, no company was able to quantify the costs precisely. Figure 25 represents the percentage of companies that intend to support dual environments in either their target environment or throughout the entire organization. It also quantifies for how long these organizations expect to support the dual environments.

Fourteen percent of the users expected to support dual environments for less than one year. The same amount expected to support dual environments for more than five years. Forty-three percent had not decided if they needed to support dual environments at all.

Figure 25 — Length of Time Organizations Will Support Dual Desktops

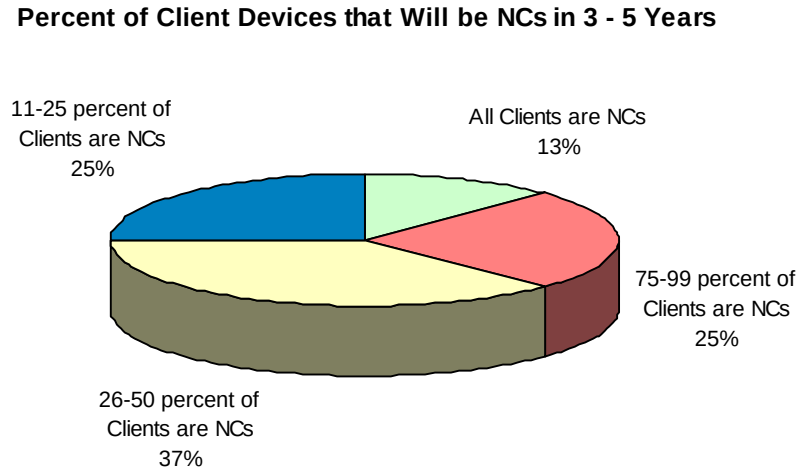


XIII. ADOPTION RATE OF NETWORK COMPUTER DEVICES IN ORGANIZATIONS

Since all the organizations in this survey were in evaluation or pilot stages of deploying network computer devices, META Group wanted to understand the companies' expectations for long-term conversion of the current desktop devices to network computer devices over a period of three to five years. This gives META Group an idea of the percentage of companies that intend to either continue using PCs or completely move to network computer devices in the future.

Figure 26 details the percentage of clients that companies expect to be network computer devices in three to five years. Thirteen percent of the companies expect that all their client devices will be network computer devices in that time frame. Twenty-five percent expect the majority of their desktop systems to be network computer devices. Another quarter of the respondents indicated that less than 25% of their entire company's desktop systems would be converted to network computer devices. However, this last set of responses was primarily from companies still in early stages of evaluating these devices.

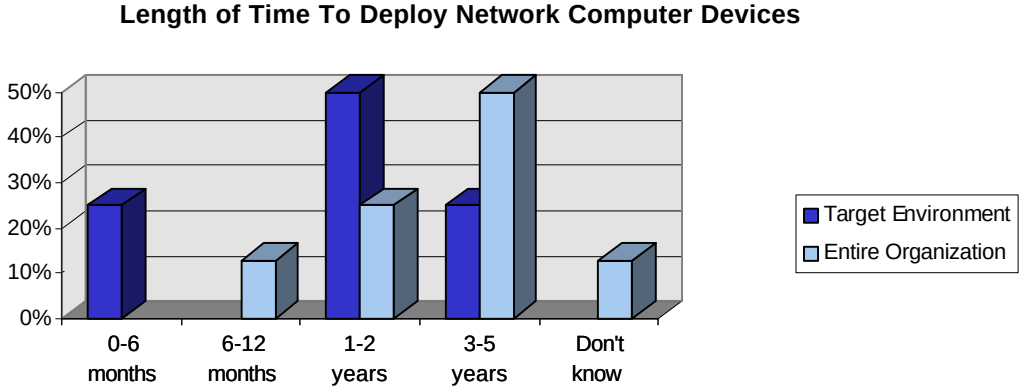
Figure 26 — Percent of Client Devices that Will be Network Computer Devices in 3-5 Years



XIV. ADOPTION RATE OF DEVICES THROUGHOUT TARGET AND ENTIRE ENVIRONMENT

After gaining insight into each company's long-term intentions for moving to network computer devices, META Group wanted to understand how quickly the companies would be deploying these devices throughout the target environment and extending from the target environment throughout the entire organization. Almost half of the respondents expected to fully deploy network computer devices throughout their targeted environment within one to two years. The same number expected to have deployed the planned percentage of network computer devices throughout the entire company within three to five years. Figure 27 graphically represents the deployment rates of network computer devices within organizations.

Figure 27 — Rate of Deployment throughout the Target Group and Entire Organization



Case Study Reports and Analysis

META Group mailed surveys to 52 Global 2000 end-user companies. In this section, we have included 16 case study histories of companies that are evaluating, migrating, or deploying network computer devices within their organizations.

META Group believes these case studies represent the typical opinions, experiences, and strategies of all participants in this survey. We have selected the most interesting examples in terms of what companies are looking for and the benefits and drawbacks, from the respondents' points of view, of network computer devices. Since many companies did not want to be identified or have their strategies discussed in this paper, we did not include every interview. In some cases, characteristics such as revenue or specific locations were deliberately omitted to preserve the anonymity of the participating company.

I. CASE STUDY
NETPC: PRINCIPAL INDUSTRY — AIRLINE

This is a $2 billion company with 21,000 employees located in 8 major cities, most major airports in North America, and at all major airports in its home country.

Case Study Synopsis

The company's goal is to find a way to normalize 70 different types of PC models and all the different configurations of PC desktops. The company wants to get a single platform solution that can run a single word-processing package, e-mail, and a major reservation system application. It wants to manage viruses, software licensing, and all aspects of the desktop. Currently, there are 118 different configurations that must be supported, managed, and implemented across the different desktops. This results in 118 different application templates that must be individually created, installed, and tested across all the different types of hardware and memory configurations within the organization. For instance, there are four different word-processing packages installed in this one organization: Word Perfect, MS Office 4.2, MS Office 95, and MS Office 97.

The Primary Objective

The company is making plans to move to NetPCs, beginning January 1, 1998. It is planning to upgrade 80% of its users in the organization within two years. NetPCs will be used to lower support and installation costs, and eliminate the new software rollout nightmare that the company is presently encountering. The major applications that will be run are a reservation system, a management system, and inventory control systems. The goal, according to the MIS manager, "is to turn the desktop into a device similar to a telephone, where you don't have to swap out the telephone hardware to take advantage of new software and features." The company wants to get off the "upgrade" treadmill, where it is constantly replacing PCs every six months. It also wants to eliminate users' ability to install and run their own personal software and applications.

Case Study Details

Currently, the organization uses a plethora of brands and configurations of desktop PCs for running its reservation system. The company has more than 2,500 desktop systems with Windows 3.x, Windows 95, Windows NT, OS/2, Unix, and DOS. It also has Macintoshes and more than 7,500 dumb terminals within the company. Servers include Novell Windows NT, Unix, and MVS and some other mainframe platforms. Network computer devices will be distributed on Windows NT, MVS, and Unix, as well as Oracle server platforms. The company is beginning to develop client/server applications.

The organization currently outsources its network support, help desk support, and all upgrade activities. Its goal is to use the NetPC to run Internet and intranet applications, to control client administration costs, to do inventory access and processing, and to replace most of its 3270 dumb terminals. The NetPC will also be used for multimedia desktop applications. The primary application is for Inter/intranet usage. These devices will run mission-critical applications, including human resources, enhanced Web-based information transfers, and communication between business partner companies and alliances. The company will be developing office automation operational systems with the help of an outsourcing firm. It will also be developing new mainframe applications and doing some customization of PeopleSoft applications to meet its own needs.

There is a real interest in migrating much of the company's business transactions to an Inter/intranet basis. For instance, many problem reports are completed manually by workers and mailed into the company. Consequently, it may take up to six weeks for a minor problem to be fixed. Now, the company can write a Web-based application that can sort problems according to urgency. Consequently, problems that need to be fixed would be escalated to the attention of the appropriate person almost immediately. In addition, many of its business partners are exchanging crucial documentation across intranets. Employee information, company policies, medical forms, expense reports, etc. can be submitted across the Web as well. Customers will also have access to special Web-based transaction pricing, which will make it attractive for them to use the company's Web site for business transactions.

The technology is sound and there are sound financial and business reasons to want to drive the migration to network computer devices. However, the company anticipates that unless it puts in strong management teams experienced with this type of re-engineering, the costs and the implementation may become prohibitive. If the transition is improperly managed, costs will escalate.

IT managers would like an "army" of experts to hold users' hands throughout the migration and early transition to new hardware and applications. They want people on-site to support and train their users while they are in the "learning" phase. Their experience with the uncontrolled, runaway costs of migration comes from a previous event when they migrated their users to a new version of the reservation system. The functionality was so different from the original system and training was so inadequate that the company resorted to hiring more than 200 reservation agents to handle backlog and transition problems. They spent more money on that project fixing back-end problems. It is their intention to spend money upfront and do the migration and training properly, before the users are given new systems.

Bottom Line

The company expects a few main benefits be derived from NetPCs. It anticipates lower support and installation costs, due in part to easier management of internal software inventory. The company also expects to reduce or eliminate problems associated with different and/or incompatible application implementations and versions, and also hopes to eliminate software piracy.

The main disadvantages will arise from the migration to NetPCs. This has to do primarily with the unknowns associated with trying to manage a major corporate culture change. The company also expects an increase in maintenance costs with NetPCs over the costs for dumb terminals. IT managers believe the complexity of the device will be primarily responsible for driving these costs up.

II. CASE STUDY

NETPC: INDUSTRY — HEALTHCARE

This study concerns a $6 billion healthcare company with over 12,000 employees in more than 25 locations.

Case Study Synopsis

This healthcare company needs to find a way to reduce its computing costs and consolidate its diverse collection of computers to a more manageable and more interoperable set of devices. The company is also developing new, more sophisticated and efficient client/server applications and needs low-cost, centrally managed devices that can access these new programs. Consequently, all the different types of network computer devices are being evaluated by departments throughout the organization. Each department or division will select the device that is the best choice to run their mission-critical client/server applications. Due to the diverse nature of this business and the number of application-specific mission-critical tasks that must be performed, it is most likely that all three types of network computer devices will be deployed throughout the organization.

The Primary Objective

The primary goal of the company is to reduce all of its computing costs: hardware, software, and particularly support. As the company has grown and consolidated with other healthcare industry companies, there has been a plethora of different desktop and host systems that each department acquired over the years. In some cases, the older systems are being replaced. In others, there will be new, state-of-the-art, image-based applications that are developed to aid the processing of information and data collection. The company needs to improve the stability and reliability of its client platforms. It also needs to be able to deploy a platform that is capable of running mission-critical client/server applications and still access many of the legacy mainframe applications and data. While a single desktop platform is not possible in the near term, anything that can be done to reduce the sheer volume of diverse nonstandard platforms will help rein in costs.

Case Study Details

Due to consolidation of various companies, rapid growth, and acquisition, the IT departments throughout the company have found themselves the custodian of a diverse set of computer hardware and software platforms. The various systems feature different configurations, models, processors, and operating systems. In addition, many locations are running "customized" versions of the corporate applications or their own software. Consequently, interoperability among different departments and different physical sites is often difficult at best. Support for these various systems is extremely expensive, manual, and time-consuming.

In an industry under the close scrutiny of a variety of government regulatory agencies and state regulatory industries, it is crucial for this company to find more efficient ways to manage escalating costs. Consolidation of computer platforms and software, reduction of spiraling support costs, and a move to adopt more standardized and interoperable systems are major goals of IT management. Currently, there are too many problems with desktop systems, which can only be resolved with manual intervention at each client's desk. The company would like to achieve central management of all IT functions.

At present, there are a series of internal evaluations of different types of network computer devices throughout the organization. Different departments are reviewing each of the different types of network computers to determine their suitability to the department's applications and data requirements. The most likely candidates are the NetPC and host-based network computer devices. This will enable the company to begin to consolidate its desktop solutions to more manageable proportions. It is, however, possible that some of the divisions may be planning to deploy JavaStations for their Unix client/server applications as well.

Consequently, there is a strong possibility that all three of the different types of network computer systems will end up being deployed somewhere within the company. Part of the reason is that there are many dedicated applications that are specific to one single department and or one individual person's job function. These applications are mission-critical and essential for a specific task that has to be performed (e.g., a dedicated US Treasury application, a specific banking or investment firm application). The major deciding factor of the choice of the specific device will be the internally developed client/server application and the devices' ability to access and fulfill an individual department's unique application requirements.

The company is planning a move to more image processing and is looking at desktop devices that are capable of doing image processing and running multimedia applications. This may also force a specific division or department to remain working with full-function PCs.

IT management wants to move 25% to 50% of its users onto network computer devices within the next two years. However, since there are so many different types of evaluation projects within the company, there are no other projections or considerations that can be quantified at this time. The overarching goal is to reduce computing costs. This will be achieved as long as most users adopt standard desktop platforms that can be centrally administered and managed.

Bottom Line

At this point in the evaluation period, there are no conclusions that can be drawn by the company's IT management regarding cost projections, increases, or savings for network computer devices. Most executives agree that network computer devices should end up reducing support costs significantly. However, the jury is still out, and the final decision on platform type and function has not been made.

III. CASE STUDY

NETPC: INDUSTRY — RETAIL

This case study involves a $1.2 billion company in eight geographic locations, with 3,500 full-time employees and another 3,500 temporary workers at Christmas time.

Case Study Synopsis

The company is in the early stages of evaluating NetPCs and host-based network computer devices. They are also very interested in full multimedia technology to enhance their operation and give them a competitive edge. Consequently, they have not decided whether network computer devices are the way to go. Due to the large influx of seasonal temporary employees, the IT managers are looking to move to a system where employees could be easily trained and become productive with a minimal amount of effort and support. The existing mainframe-based applications are cumbersome and require custom applications.

The Primary Objective

The primary objectives are to reduce the amount of phone time spent with customers trying to order merchandise, to standardize on products that can utilize off-the-shelf applications, and to reduce overall support costs with suppliers and vendors. The executives are also looking for a desktop system where temporary employees could be trained to become more productive in a shorter amount of time. The company would rather spend its training budget on helping workers to become better salespeople than to help them become more adept at using one type of system. Other equally important objectives include having the ability to track older catalog items easily and having a system that would be able to process orders even if the mainframe or server failed.

Case Study Details

This direct marketing company depends on its computers for complete call center operations and applications. The company uses its systems for retail marketing, catalog distribution, customer service, order entry, office productivity applications, and customer support.

All of the company's applications reside on a mainframe or server and are accessed using dumb terminals. As the company looks to update its systems and applications, it is considering a variety of different computer paradigms, including the NetPC and host-based network computer devices. The vast majority of the applications that will be accessed by network computer devices are order-entry applications. The IT managers are considering the NetPC as a possible desktop solution, though they have not ruled out going to a pure PC solution. Part of the evaluation

process will entail measuring cost savings and making a decision on the type of applications that will move the business toward more profitability and greater sales volumes.

The company is also planning to utilize the Internet as a merchandising and sales medium. Online multimedia catalogs and Internet sales plans are in progress. Executives in IT would like to be able to use applications that can process Internet orders offline in case of a mainframe or server failure. Previously, when the system went down, employees had to take the time to manually fill out and hand-process order forms. Using the Internet, employees can process the order electronically offline and upload the order once the computer is back online.

The number of employees doubles during the Christmas selling season. Training temporary seasonal employees often involves spending more time teaching the employee about how to use the system than how to sell effectively. This is a process that everyone agrees should be addressed and rectified.

IT is planning to move approximately half of the employees to a new desktop device in the next one to two years. They expect to have replaced all their terminals within three to five years, while keeping support costs and application distribution costs the same as they are currently. The training budget should remain constant, because the training budgets will be used to turn employees into more efficient salespeople, rather than make them mainframe experts

Bottom Line

By achieving its goals of standardizing on a single platform and using a system that is robust and reliable, the company expects to save money on training costs and reduced "talk" time with customers placing orders or requesting service. If all goes according to the IT managers' wishes, support costs would decrease dramatically. The existing legacy computer systems are showing their age and beginning to be difficult to support and keep running. Network computer devices will dramatically reduce the training time for seasonal and temporary employees. Browser-based network computer devices would both enable the marketing company's employees to do a better job selling products, servicing customers, and tracking products, and let them run many off-the-shelf customer care applications, including Federal Express package tracking. These applications simply can't perform as well on text-based terminals.

The network computer devices that this company has been evaluating have problems running off-the-shelf applications. The problems involve having to implement a WinFrame Citrix server in order to run Windows applications. This means IT will have to install a new type of server, which increases the risk of failure and adds an additional support requirement on the help desk staff. IT believes NetPCs may be a good choice for this company, because many of the applications can be fixed, the devices are cost-effective, and the company considers the device itself "disposable."

However, the company is battling a dilemma. While the advantages of network computer devices are clear, this marketing company sees voice and multimedia capabilities as valuable and desirable marketing tools. The company wants to be able to easily locate and display last season's items. The company envisions an online catalog, where the customer can see what he or she is ordering and talk to the sales representative. It also recognizes that multimedia interaction

could reduce the amount of sales time and deliver what the customer really wants. This would cut down on returns and increase customer satisfaction. However, none of the network computer devices that would easily fit into their environment is capable of supporting the company's multimedia visions. Consequently, the company is still evaluating whether Windows-based multimedia PCs are a more suitable choice than network computer devices.

IV. CASE STUDY

HOST TERMINAL REPLACEMENT: PRINCIPAL INDUSTRY — AIRLINE

This is an airline whose annual revenues exceed $17 billion. There are 90,000 employees, with 10,000 dedicated computer users across 250 geographic locations.

Case Study Synopsis

Currently, the company has more than 10,000 employees working with productivity applications on 773 different configurations of PC operating systems and software packages. Every time a software package has to be installed or a software change needs to occur to a system, someone must physically visit each individual desktop and make that change. Because of the different versions of software and the different configurations, the first-time failure rate of installation is high. In addition, training is often minimal, resulting in a high level of support required per user for every software upgrade that is made. The business case for migrating off traditional PCs to the desktop computer is being driven by a need to reduce total cost of ownership, consolidate the company's diverse hardware desktop platforms, and to make its application rollout and delivery more efficient and flexible. The company is in the process of evaluating several different client/server solutions, desktop products, and network computer devices, to determine the most cost-effective way to manage its working environment.

The Primary Objective

There are two major objectives. First, the company has to consolidate its diverse platforms and drastically reduce its support costs. Second, the company has to create a computing environment that is flexible, integrated, and cost-effective. Each department has implemented its own computer desktop solutions. In addition, a major portion of the company's business is conducted using dumb terminals. The power users run an Intel 486 or better desktop system with Windows 3.1, Excel, Microsoft Office, and other productivity applications. The maintenance, management, and software interoperability issues with this type of environment add up to a monumental headache for the IT department and consume a large part of the budget. The goal is to migrate, in approximately 18 months, to a very thin client device running a browser, with all data and applications residing on the server. The environment will need to be extremely robust and consistent. The objective is to reduce administrative and support costs by moving to a single desktop platform and managing the desktops from a central site. Users will not have disk or CD-ROM drives on their devices, and all software will be distributed and managed from a central location. Each department is pursuing its own investigation of replacement desktop alternatives; after IT management considers all the evaluation results, it will make a final decision regarding appropriate migration.

Case Study Details

This $17 billion airline is moving to network computer devices to get a handle on managing the costs of supporting its desktops. This corporation is structured so that each department assesses its own IT needs. Over the years, this has resulted in an accumulation of a plethora of desktop devices, operating systems, and different hardware configurations, and an attendant systems support and management nightmare for the IT division. Every software release has to be customized to support 772 different versions of hardware/software combinations across almost 10,000 computer systems. The software is manually installed on every system and the time to migrate users over to the new software is, according to the IT managers, "horrendous." The risk of exposure during the transition period is also unacceptable, as software incompatibility and bugs have to be addressed differently for each system and require a support person to physically call on the system to troubleshoot the problem. New software application releases have been so difficult to manage that, in one instance, the company had to resort to hiring an additional 200 people to take care of the backlog of data entries and problems after rolling out a major revision of a mission-critical application.

Consequently, the decision has been made to eliminate fat clients, operating system redundancy and incompatibility, and the requirement of having to support hundreds of different software versions to accommodate the variety of systems within the company. The panacea is the host-based network computer device. The company will install extremely thin clients and use a browser-based desktop. It will install a browser based version of SAP. It also plans on accessing its database with these devices. The IT managers plan to pull reports from the database and get back HTML pages. All future application development and design will be browser based as well. The management hopes that users will willingly move to these network computer devices since most of them do not know how to use the more sophisticated commands and features of the applications on their PCs.

Select PCs are being utilized for heavy data manipulation activities. The applications involved require local storage for data processing and probably will not move to the new platform. The company expects to encounter a rebellion from a few of its power users on PCs, who will not want to give up their PCs or their disk drives in favor of a more standard solution. But the IT department believes it has solved this problem in a unique way. Each department incurs a fixed support cost per user. Departments whose users move to the network computer devices will pay a lower cost for supporting each user than they do currently. This cost reduction is expected to be derived from the savings achieved in centralized support and management of applications and systems. Users who continue to use fat clients or PCs will pay a fee that could be as much as six times higher for the support of "nonstandard" devices. The company is prepared to make the tradeoff of reduced user flexibility for greater interoperability and a more consistent computing environment.

Concerns include the unknown costs for migrating to a new platform and for training all users on a device that is far different from the PCs to which they are accustomed. There is also a real concern about the wiring and corporate real estate in some of the older buildings. These older sites may need to be rewired to support the new paradigm.

The IT department plans to convince management to spend time developing training courses and training employees before the move. Thus, the business operation can run more efficiently, even during the migration from PCs to network computers.

Bottom Line

The company is hoping to achieve a 2%-3% increase to their bottom line, though IT managers may never be able to actually measure the costs. The anticipated benefits will arise from use of the Internet and Web-based technologies. The company expects its software and hardware maintenance costs to decrease significantly. Software deployment costs will certainly be a significant area of savings for the organization. The organization does not expect to see its application costs change or decrease; however, IT managers anticipate that they will get more productivity for each dollar spent on the network computer devices. The hope is that users will be at least 25% more productive with the same headcount. This expectation is based on the assumption that users who are not "futzing" with operating systems, DLLs, and other system-level tuning will be able to spend more time learning to use the applications efficiently.

V. CASE STUDY

HOST TERMINAL REPLACEMENT: PRINCIPAL INDUSTRY — CITY GOVERNMENT

This case study involves a city government with 10 geographic locations and 700 employees.

Case Study Synopsis

The city supports a police department running Web-based applications, as well as a parks and recreation department and a building division running X-Windows applications. The city's original plan was to upgrade its police department with laptop computers. However, a cost analysis proved that this was too expensive. Instead, the police will be supported using mobile thin clients accessing Web-based workflow applications. The organization is in the process of replacing all of its VT-220 dumb terminals with NCD Exploras.

The Primary Objective

The primary objectives were to avoid costly upgrades, maintain centralized support, control software installation costs and manpower efforts, and focus users on working on the applications, not on the operating system or utilities. The city has been running SCO Unix and supporting VT-220s and NCD X terminals. They also run one Windows NT server with software from NCD. They recently converted their NCD X terminals to network computer devices by just replacing a small piece of server software (the boot image on the host). They now have 150 X terminals that were upgraded to network computer devices. As a result, more than 100 users who previously ran alphanumeric-character applications are now running graphics applications. There are still 350 terminals that will need to be replaced. One hundred of these will be replaced in the fall by network computer devices. The remaining desktop systems belong to remote users; until the city can install frame relay from the local phone company, they will not be upgrading this group. The system upgrades for the entire city will be completed within five years.

The Case Study Details

This city government does not want to continue replacing its PCs every 18 months to five years. Instead, it wants to purchase devices with some longevity. Had the city purchased PCs two years ago instead of network computer devices, the city's money would have been wasted. The systems they purchased would now be under-powered and unable to run the current applications. Using network computer devices, the city leveraged its investment in hardware. With a minor software upgrade, it expects to see a 10-year life cycle with network computers. Instead of users wasting time teaching each other the fundamentals of PC operating systems, they spend their time learning the applications. There are no disk drives, so users can't bring in outside software, games, or utilities. Management of the desktop is done centrally through a server located less than 10 feet away from the IT manager's desk.

Training costs have not changed. The city held classes to teach users the new applications and productivity tools (e.g., the latest version of WordPerfect). After the initial training expense, training costs have returned to what they were before network computer devices were installed. The city has upgraded its server so it can now support a 30% increase in network traffic, which is a direct result of the users' new ability to run graphics-based applications. It bought switched Ethernet. The city plans to upgrade its servers in the near future. It will install three quad Pentium Pro servers running Windows NT with 1GB of RAM, at $15,000 each. The city will also purchase two 8mm backup devices at $4,000 each. There has been no other impact on network bandwidth or performance.

The conversion was easy. All applications that were running can be accessed. There was no downtime during the swap-out. The original network was set up to support users from a central location, so support and central administration management issues are unchanged.

The only application that can't be converted is a digital camera application. There is a Windows bug that NCD can't work around, involving the ability of Windows to recognize and open a communications port on the NCD device.

The network computer devices are used primarily for controlling administrative costs, for database and Inter/intranet access, as Windows-based PC alternatives, as multimedia desktops, and as replacements for dedicated applications, dumb terminals, and X terminals.

All applications are network-based and 100% network-processed. The applications that run on the network computer devices are used for a wide variety of applications, including Java-based applets. The primary application is for e-mail, calendaring, and scheduling. The major mission-critical applications at the city are GroupWise, WordPerfect, and some internal financial applications. Network computer devices can run all the city's applications, including the VT-220 applications.

Bottom Line

The real cost savings were realized via increasing the life expectancy of the hardware and reducing refresh rates. According to the MIS manager, "the expected life cycle of a PC is not suited for a government." The cost of the desktop device is initially the same: approximately $1,200. The difference in savings comes about when, after four years, the desktop device doesn't

need to be upgraded or replaced. Additional cost savings are anticipated from the ability to support applications and systems from a centralized location.

VI. CASE STUDY

HOST TERMINAL REPLACEMENT: PRIMARY INDUSTRY — FOOD MANUFACTURING

This is an $80 million company growing at 5% per year. It is located in one city and employs 450 people.

Case Study Synopsis

This is a typical food manufacturing facility that is turning to IBM Network Stations as a "cost avoidance" solution. IBM Network Stations will be used to replace and/or refresh dumb terminals. The company is also setting up a corporate intranet and will use browsers as the basis for interfacing to the applications. Anyone within the company can monitor what is happening in the manufacturing process and can access whatever information that IT managers need. No longer confined to text only, the company is planning to implement high-end imaging solutions, so hardware specs, operating diagrams, and schematics of the machinery can be placed online. Thus, making repairs becomes much easier than when people had to find a hard copy of the manual, look up the appropriate diagram, and try to figure out how the parts fit back together.

The Primary Objective

The company's major goal was the desire to implement high-tech solutions with low-cost technology, thereby avoiding the more expensive computer hardware and software products and their associated high costs. The company plans to use network computer devices to control client administration costs, and to add Internet and intranet application access. The products that are installed must be robust with "bullet proof" reliability. IT managers must also be able to process images and graphics. Since the company usually performs a major revamp of its software systems every two years, refreshes and bug fixes have had to be done manually. So, the company was also looking for an easy way to propagate vendor software updates to their users. End-user training is another factor, though slightly less significant. Currently, training is outsourced and users go to a training class once. The opportunity to provide online training with the new systems and bring the training inside is a factor that will help increase user productivity.

Case Study Details

The food manufacturing company is planning to replace more than 100 of its desktop client systems with network computer devices. All dumb terminals will eventually be replaced by these devices as well. The majority of these systems are replacements/upgrades rather than brand-new systems. While most of the existing server problems revolve around performance issues directly attributable to installation of new software, the server will be updated to provide better

performance. Fiber optic cable will be installed throughout the complex to replace existing aging wires and to support a new breed of applications.

The company's entire business, from planning to factory floor monitoring to analysis of results, is done online. These applications, as well as all the applications now run on the AS/400, will be able to be run by the network computer devices. Network computer devices will be used for Internet access, word processing, spreadsheets, Java applications, transaction processing applications, inventory control and management, order entry, and other LOB applications. Existing applications and data are on the server. Nonetheless, about 25% of the time, some users may run Java Smart Suite or Java applets. This ratio will remain the same after the network computer devices are installed.

The only applications that will not be able to be run on the network computers are the big financial spreadsheets.

Bottom Line

Error handling is expected to be much improved over the existing solutions because the PC's general protection faults and other operating system errors are not seen on the AS/400. Also, error processing appears to be much faster whenever it is centralized. The company's pilot tests confirm this is true on the Network Stations. The IT department also is looking forward to being able to process software patches and updates from a central location.

The most unexpected result the IT director experienced when IT managers installed the pilot systems was in the area of overall performance. Because IT managers were migrating away from pure text to graphics and more complex data manipulation, the IT team anticipated up to an 8x performance hit. In fact, the Network Stations were able to deliver a performance throughput that was almost equivalent to a 200MHz Windows 95-based PC. Considering the vast difference in price between the fully loaded PC and the minimal Network Station, the IT director and staff were "pleasantly surprised."

VII. CASE STUDY

HOST TERMINAL REPLACEMENT OR JAVASTATIONS: PRINCIPAL INDUSTRY — AUTOMOTIVE

This $9 billion division of a major European automotive organization has 36,000 employees in seven geographic locations.

Case Study Synopsis

This European automotive company division is in the process of upgrading legacy applications and modernizing its computer facilities. The company is migrating its mainframe applications to a 3-tier client/server architecture. As the corporation expands and partners with other automotive industry companies, it needs a more open computing platform. It wanted a platform that could access the new client/server applications as easily as it could continue to process mission-critical legacy applications still residing on the mainframe. Network computer devices that are host-based will most likely be the company's platform of choice. Several different manufacturers' products are in various stages of being tested.

The Primary Objective

The company uses a mix of legacy DEC hardware and mostly homegrown applications. It has outgrown its mainframe-based solutions and is moving to a client/server platform in order to become more standardized throughout the organization. Company executives also required a computing platform that is standardized across different divisions and sister corporations with which the company does business. The system must also be capable of transitioning between the mainframe's legacy applications and the Internet and new client/server-based applications. Because of the legacy of X terminals within the corporation, the device the company selects must also be complementary to the company's legacy X applications. Currently, the division conducting this pilot is migrating most of its platforms to Sun JavaStations and more resilient fault-tolerant servers. In the future, the company wants to be able to buy off-the-shelf applications rather than continue to rely on developing applications in-house.

Case Study Details

This 36,000-person European automotive company is moving to network computer devices in order to develop and support brand-new applications that meet its current business requirements. In the first pilot, the IT managers are evaluating a variety of standard, host-based network computer solutions that will help them manage a greater workload using fewer people. Network infrastructure and wiring was installed in anticipation of procuring network computer devices. The network computer devices in the pilot phase are not replacing outdated desktop systems. However, within other areas of the company, the old coax that supported the company's 3270 terminal emulation-based applications is not able to support network computer devices. Consequently, to migrate the rest of the company over to the new applications, IT managers will have to upgrade the entire outdated network infrastructure.

The company will use network computer devices for communications within the corporation and its sister companies across an intranet. All transfer of information from automotive specifications to human resources polices will be done across the corporate intranet. The network computer devices will also be used for database access, inventory control access and processing, replacement of existing 3270 terminals, running/accessing Internet and intranet content, and word-processing/spreadsheets. These devices will also run other office productivity applications, including e-mail, calendars, and database access/updates. The company is planning on using Java to develop many of its new applications, including an internal help desk. In

addition to performing problem and change management functions, the devices will be used for inventory control and management. They will be linked to the mainframe and will run legacy and brand-new applications. The migration to network computers in this company is expected to be completed within two years.

Bottom Line

The network computers seem to have proven that they will be able to run legacy and state-of-the-art mission-critical applications: supporting bill of materials, parts inventory management, etc. Having a standardized platform is expected to be able to reduce the total cost of ownership of desktops within this company. The company's mechanical CAD applications and the software that is critical to this company's design and development of new products runs on workstations. Network computer devices cannot replace these mission-critical applications and will be unable to access the software. Eventually, all the CAD software will be ported to servers where the application and data can be run by network computer devices. The company is also planning to use network computer devices to run its Windows-based applications.

No changes in application support costs are anticipated once network computer devices are deployed. A major concern still revolves around network costs and upgrades. Current pilot tests seem to be generating a significantly greater amount of network traffic than the dumb terminals had. IT managers are also concerned with being able to centrally control and manage the applications that are running and where they are being deployed.

VIII. CASE STUDY

HOST TERMINAL REPLACEMENT OR JAVASTATIONS: INDUSTRY — INTERNATIONAL AIR CARGO

This international air cargo company has revenues of more than $10 billion and is anticipating an 18% increase in company revenues in the coming year. The company operates in more than 200 countries or territories. It spends over $1 billion annually in technologies that enhance customer productivity and satisfaction.

Case Study Synopsis

The company invests heavily in technology and claims that the investment pays for itself in improved efficiency. It is in the process of replacing its 3270 terminals and some of its PCs as part of a companywide move to streamline costs and standardize its computer operations using thin clients. The company's goal is to have 75% of its applications and data processing done on network computer devices. It plans to roll out more than 75,000 thin clients within two years.

The Primary Objective

The company wants to be able to reduce its "tremendous" support costs and eliminate the need to manually update and install software on desktop PCs. It wants to make its employees more productive by supplying them with tools that make their jobs easier to perform. The company

also wants to eliminate its 3270 terminals, to create and run Java applications and intranet applications. However, the company still must be able to run Windows productivity applications.

Case Study Details

The company is currently undertaking a small pilot test using JavaStations, NCD Exploras, and other host-based terminal types of network computer devices. It is using Citrix and Windows NT on the server. One of the first goals is to level off the amount of support staff that manually installs software and patches and maintains the PCs in the field. This generally involves 600 people. The company expects to maintain this number of support people for the network computer devices.

The company intends to run all its existing applications, from spreadsheets to workload planning, on the network computer devices. It also is in the process of installing a variety of new applications that will reside on the server and run on network computer devices. One of the first new applications will contain computerized local street maps and will enable a company employee to do short-range route planning for more time-efficient daily delivery schedules. Currently, this is not done in as efficient a manner as it should be. The employees often use paper maps and manual means to plan out travel routes and delivery priorities. It is the company's intention to have the drivers run this application across the intranet. The company intends to install 75,000 network computer devices within the next two years, but will also maintain close to 30,000 Windows-based PCs and workstations.

The new devices will not be used for the engineering-intensive applications that run on sophisticated workstations, such as flight route planning and some critical operational tasks. While there is nothing inherent in the device that would prevent the company from porting these applications to servers, the IT managers do not believe it is worth the effort at this time. Another use for the network computer devices will be to run computerized training to teach employees to become better drivers and improve their efficiency.

The JavaStations are being considered for multimedia applications that will be deployed.

Bottom Line

The IT managers expect to reduce desktop support costs and maintain the level of people required to service computers in the field offices. However, they don't anticipate any effect on their application development or application support costs. Early pilot tests indicate that the network computer devices they are testing run applications much faster than the current 486 or Pentium 75MHz systems. Consequently, the IT managers anticipate that they will have better employee productivity using devices that they describe as "more responsive". IT expects a fourfold increase in the number of servers currently installed in the next five years. IT hopes that the Java applications will be more maintainable than many of their in-house applications have been. Finally, the IT managers admit that there is no cost savings in the actual price of the network computer device compared to their existing PCs. Their own estimates are that network computer devices will cost them from $1,200 to $1,300 by the time they add the monitor and some additional support items. The major benefits will be derived from lower maintenance and

support costs of the desktop devices and greater productivity gains across the organization through the combination of better applications and faster devices.

IX. CASE STUDY

JAVASTATIONS: PRINCIPAL INDUSTRY — FINANCIAL SERVICES

This is a major financial services organization employing 25,000 people across seven geographical locations.

Case Study Synopsis

This organization is migrating its administrative employees and specialized financial workstation users to network computer devices first. Management has concluded that network computer devices are cheaper than PCs. The IT department is in the investigative process to determine the real costs of ownership while they evaluate the best vendor solution possible to meet the needs of the employees. There are still many factors to consider before a decision is made to migrate office productivity workers and other company employees to network computer devices. The company is evaluating Sun's JavaStations, along with network computer devices from HDS, NCD, IBM, and Wyse.

The Primary Objective

The company's major goal for moving to network computer devices is to reduce costs of the desktop systems for employees that do nothing more than calendaring, mail processing, and word processing. The need to reduce costs of administration and support for these devices is also paramount, since all software upgrades and support are done by manual intervention at the desk. Furthermore, the company is beginning to utilize more Internet and Web-based technologies in its internal applications and business processes. A secondary benefit would be that the company might be able to reduce support staff.

Case Study Details

The initial draw to network computer devices were their costs relative to the costs of an average Windows-based PC sitting on users' desks. A fully configured, full-function PC is not required for administrative workers who spend the majority of their time processing e-mail, scheduling meetings and appointments, and doing basic word processing. There are customer representatives who work on financial workstations running dedicated financial applications. For these workers, JavaStations or similar function network computer devices make sense as a way to control costs of administration and desktop hardware. The systems will be used to do Java application processing as well as order entry.

Currently, the company plans to implement network computer devices in several key areas of the business. They will be used as replacements for Windows-based PCs and for diskless PCs. These devices will also be used to run dedicated applications or used as dumb terminal replacements. The company hopes to be able to ultimately require a smaller staff of people to

support, service, and administer the desktop devices by moving to centralized support and administration of desktop systems. The IT managers anticipate that software distribution costs will drop, since software can be loaded from the server rather than by manual insertion of disks, which is the current method.

The company is evaluating a variety of devices in several departments. It is possible that more than one type of device will eventually be adopted. Some of the older applications are being rewritten in Java to see if network computers will be workable in those departments. The first results of these applications appear to be workable solutions. Some of the fat client applications that were created for internal use are also being rewritten so they can be ported to network computer devices. The company plans to move between one-quarter and one-half of its users to network computer devices within the next three years. The first systems are expected to be deployed within six months.

The IT managers have a real concern about the impact that network computer devices will have on their network bandwidth. Early indications are that traffic will increase to a point where the current network infrastructure may become saturated by some of the devices that they are investigating. Other solutions employing WinFrame solutions may prove to have a smaller impact on the network than some of the systems in the pilot projects. However, the WinFrame implementations are proving to be more difficult than the company expected.

Bottom Line

Overall, the company executives believe that there will be financial advantages and cost savings by adopting network computer devices. However, no solution is going to be effortless. And impact studies on the network traffic, bottlenecks, and the real costs of servers to support network computer devices have not been completed. Concerns still exist among the IT staff that there are hidden "gotchas" that have not yet surfaced. There is still much more testing and evaluation that will have to occur before any device will be adopted. Some applications will have to be ported or at least rewritten. Some of the WinFrame implementations are proving to be much tougher than the vendors described. The development of Java applications appears promising. Overall, the IT managers believe that there will be some penalty involved with any migration to a new desktop device. But at this juncture, they are committed to migrating to a thin client. The IT managers are just not sure which solution will be the "best fit" to meet all their needs. Therefore, evaluations of all the products continue.

X. CASE STUDY

JAVASTATIONS: INDUSTRY — RETAIL

This is one of the world's largest companies of its kind. The company coordinates and enables over $1 billion in transactions per year with peak transactions reaching more than 1 million orders per day during specific holiday periods.

Case Study Synopsis

The company has been evaluating JavaStations and some other network computer devices for the purpose of improving its marketing, making its order processing more efficient, and upgrading its computer technology. The company had previously upgraded its mainframe and dumb terminals to PCs several years ago. However, the costs for supporting and maintaining these systems has proven to be far more costly than IT had expected. To manage its support costs, the company is now looking at centrally managed desktop devices.

The Primary Objective

The company's primary goals were to reduce its PC maintenance and support costs, while finding a better computer solution to help it increase customer satisfaction and easily provide new customer services. The company wanted to utilize the Internet for improved communication, to exchange new ideas and to enable its customers to browse online catalogs and place orders. The support for multimedia and Internet-based transactions is one of the major attractions of JavaStations.

Case Study Details

The company was attracted to the zero administration aspect of the JavaStations as a way to reduce its help desk and field service and support costs. The company distributes thousands of copies of its software annually to users who are not "PC-savvy." The calls to the help desk and visits to each site to fix the problems that the help desk can't resolve over the telephone have been growing exponentially each year. Maintaining software on the different configurations of PCs in its field offices has also been expensive and time-consuming. When the PCs can't be used to process orders, the company loses time and money reverting to telephones and paper order processing. The company needed to get these costs under control.

As part of its plans, the company has begun to use the Internet for a variety of its business functions and as a source of business improvement and new business ideas. The company is implementing better education programs, which can be downloaded off the network. It is sponsoring customer chat rooms and bulletin boards to encourage an exchange of ideas and to learn how to put more useful promotions or products into its portfolio of services. The Internet and this new type of information exchange will be used to give the company a competitive edge.

Since PCs have proved to be too cost-prohibitive, the network computer device solution was given serious consideration. Since the company wants to enhance its online catalog business and run Internet business promotions, multimedia support capability was important. JavaStations seem to hold the most promise out of all the devices the company has been pilot testing.

Bottom Line

The company believes that by improving its business communication and by using the Internet, the pilot project has actually helped the company create more business ideas and generated better business practices among its customers. The most promising solution appears to be the JavaStation, but the company would like to see much more functionality in the coming months.

XI. CASE STUDY

JAVASTATIONS: INDUSTRY — TRANSPORTATION

This case study details the needs of a large transportation services corporation located in 76 countries with more than 32,000 automated travel agencies.

Case Study Synopsis

This is a transportation services company that provides equipment and services to other companies in the transportation sector. It also runs many of these same applications internally. The company provides schedules and information on more than 700 airlines, 31,000 hotel properties representing 195 hotel chains, and 56 car rental companies. The company wants to provide an ubiquitous, scalable solution for its internal and external customers that could be deployed easily in a customer site.

The Primary Objective

The most important criteria for this company is to have fast performance in an extremely robust environment with high availability. Any significant delay can end up costing the company thousands of dollars in lost revenue. The company wants a secure computing environment that is portable and flexible enough to be easily integrated into any customer site. Since each customer has implemented its own computer desktop solutions, it is difficult to support thousands of customer configurations. Finally, training must be easy. The company also wants to dramatically reduce its client support costs.

Case Study Details

One division of this company rewrote one of its major applications in Java and conducted its pilot using JavaStations. The transition from its existing PCs to the JavaStations was relatively easy. Training was kept to a minimum, since the clients were still accessing applications with which IT managers were already familiar.

Since part of the company's major business is providing equipment and solutions to its clients, the applications and desktop devices required to access the applications must be both scalable and interoperable with existing systems clients might already have. The ability to reduce porting and support costs is an attractive reason for the pilot study involving JavaStations and the Java language.

The pilot study is in progress, and at this stage the results look promising. Other divisions within the company are also evaluating similar network computer devices, but no definitive conclusions about which device will be deployed have been drawn.

Bottom Line

One of the most unexpected results of the pilot was the overall performance of the new system. The customer anticipated that the response time would be slower than it actually was. The

company admits that all the functionality they would like to have is not available currently. The IT managers expect support costs to decrease and they hope that their application support and porting costs will be dramatically reduced over time.

XII. CASE STUDY

JAVASTATIONS: INDUSTRY — COUNTY GOVERNMENT

Case Study Synopsis

This is a department within a large county government that needs to move off its old legacy mainframes and 3270 terminals. Previous migration attempts were expensive and ended in failure. The organization was persuaded to rewrite its applications in Java and move to JavaStations. The company wants to improve its services for its customers and to reduce its maintenance costs

Primary Objectives

The most important objective was to find a stable solution that was portable and as cost-effective as the 3270 terminals IT managers were replacing. The old mainframes are under-powered, unreliable, have a proprietary architecture, and are expensive to maintain and support. The goal is to migrate all the 3270 terminals to a very thin client device running a browser. The organization was looking for a secure solution to let them move off the mainframe completely with minimal impact on the users in the organization.

Case Study Details

All data and applications currently reside on the legacy mainframe. The company's previous attempts to move off it were expensive failures. The company had attempted to migrate to PCs, which also proved to be expensive to maintain/support and lacked sufficient security.

The major attraction of JavaStations was the promise of Java's portability along with a scalable, thin client. Officials were interested in the "run once, deploy everywhere" concept of Java. To test the concept, developers rewrote one of their major applications in Java. The efforts took three months and caused no transition delay. Users were able to move to the new network computer devices with a minimal amount of retraining. And the organization had the vendor to help them get through the first phase of the migration.

The JavaStation helps maintain the required level of security and prevents unauthorized access. The county can now easily communicate with other government offices and migrate to a standard database. Being able to support the desktop systems from a centralized location will reduce their support costs and maintenance costs.

Bottom Line

The organization has been very satisfied with the results of its pilot test. Currently, the pilot consists of 125 JavaStations. The pilot effort will be expanded in the coming months. Security came as an added benefit, since no user can accidentally load software that would impact the network or bring the system down with a virus or incompatibility problem. And no unauthorized person could access secure files without the required clearances.

XIII. SHORT SUMMARIES OF OTHER INTERVIEWS

Host Terminal Replacement — Industry: Healthcare Services

This healthcare services company is planning to use network computers to replace dumb terminals. Some of the network computers are being used as data entry systems in a highly automated mail-order system. Another department intends to deploy these systems to run Microsoft Office applications.

The company has begun a large deployment of @workStations from HDS Network Systems. The company plans on having only 50 network computer devices for each server. The company installed a Citrix WinFrame network software solution for Windows NT, so that the users could continue to run the Microsoft applications. MIS officials estimate that the total cost of each client seat, including monitor price and software licensing fees, will cost the company $1,500.

Oracle's NC — Industry: Service

This is a large nationwide service corporation that is planning on replacing its dumb terminals in its major call centers with Oracle NCs. The company's telephone representatives will have the ability to continue to access and run their mainframe-based order entry and customer service applications as well as now being able to access e-mail, view multimedia content, and perform word processing and calendaring functions. The company's main objective in moving to these devices was to increase its sales while decreasing overall technical support and employee training costs. The company is planning on porting its crucial applications to other servers for its franchisees' retail shops. The company considered deploying NT servers and networked PCs. However, early evaluation results indicated that the company could reduce its hardware and support costs by almost half if it chose the NC systems instead. The deployment of these devices is expected to be complete within 18 months.

JavaStations — Industry: Transportation

Information technology managers at a very large US transportation company have begun making volume purchases of JavaStations to deploy throughout the company as a cost-effective way to run mission-critical business applications. The network computer devices are used to monitor a variety of railroad functions and to track cargo shipments. The devices are also used for electronic commerce. The IT managers had their share of problems when they first began the evaluation of the products. However, they believe all the problems are now resolved and that the current platform is stable enough to deploy the devices throughout the company to remote sites.

Network Computer Devices — Industry: Education

A large university has asked its IT department to conduct a pilot project to evaluate network computers. The major objective is to provide services employees who previously did not have

PCs with the ability to access to campus information, the Internet, and e-mail. The university wants every employee to have basic computing access. The goal is to make a desktop device as ubiquitous and accessible as the telephone. The university considers network computer devices as a way to cost effectively provide computer access to its students and employees.

Appendix A: Survey Questionnaire

This survey captures information about your distributed computing environment. In order to accurately model your cost structure, MGC requests that you focus on a specific and controlled workgroup or campus environment within your company, which we call the "target" computing environment throughout the survey. MGC experience shows it is easier to quantify infrastructure and operations costs by examining a controlled set of clients, servers, and associated management, support, and training staff. We expect this environment to contain a mix of Windows-based PC platforms and any of the following: Unix, terminals, and network computer devices in a *division or department* setting. The target environment should be large enough to be supported by a formally defined help desk and *ideally* should consist of 500 or more clients.

All questions clearly state whether they refer to the Windows-based PC, Unix, terminal, or network computer device components of your environment.

Survey questions are categorized in the following areas:

- Demographics and Current State Information
- Distributed Computing Infrastructure Information
- Operations Information
- Network Computer Device Specific Information
- Financial and Business Drivers/Benefits
- End-User Poll

Demographics and Current State Information

Your Name _____

Your Title _____

Corporation Name _____

Address _____

City, State, Zip _____

Phone Number _____

Fax Number _____

E-Mail _____

Principal Industry _____

Annual Revenue and Projected 1997 Growth _____

Organization Size (total number of employees) _____

Projected Increase in Total Number of Employees for the Next 12-18 Months ____

Number of Geographic Locations _____

Who is the primary decision maker for the following purchasing decisions?	IT Dept. Manager	Individual Department	Corporate Management	IT and Users Together	Other (please explain)
Network computer device hardware					
PC hardware					
Terminal hardware					
Network computer device software					
PC software					
Server hardware					
Server software					
Network hardware					
Network services					

Please indicate the mix (by number) of *desktop clients* installed in the target environment. Please also indicate the total number of client devices that you expect to be in place in the next 12-18 months. Please complete both columns, so we can identify where you expect a decrease or increase in the total number of client devices.

Desktop/Client Mix	Total Number Installed Today	Total Number Expected to be Installed in 12-18 months
Windows 3.x		
Windows 95		
Windows NT Workstation		
Macintosh		
OS/2		
Unix		
DOS		
Network computer devices		
Terminal (3270, 5250 sessions)		
Other		

Please indicate the number of network computer devices that will replace existing desktop clients: _____

Which type of clients will they replace? _____

Please indicate the number of network computer devices that are new desktop clients: _____

Please indicate the total number of terminals in your entire organization:

_____

Please indicate the total number of Windows-based PCs in your entire organization:

_____

Please indicate the mix (by percent) of Windows-based PC CPUs installed in the target environment currently. Please also indicate the total percent of Windows-based PC CPUs that you expect to be in place in the next 12-18 months. Please complete both columns, so we can identify where you expect a decrease or increase in the total number of CPU types. (The total of each column *should* equal 100%.)

Windows-Based PC CPU	% Installed Today	Total % of Windows-based PC CPUs Expected to Be in Organization in the Next 12-18 months
Intel 286		
Intel 386		
Intel 486		
Pentium		
Pentium Pro		
Cyrix		
AMD		
Other		

Please provide the mix of *server* operating systems (SOSs) installed in the target environment today. Indicate the total number of servers for each SOS as well as the total number of users (e.g., 3 NetWare 3.x servers supporting 750 users). Also indicate how you expect these numbers to change in the next 12-18 months. Please complete both columns, so we can identify where you expect a decrease or increase in the total number of server operating systems. (The *total* of each column *should* equal 100%.)

Server OS	Total Number of Servers and Supported Users Today	Total Number of Servers and Supported Users in the Next 12-18 Months
Novell NetWare 3.x		
Novell NetWare 4.x		
Windows NT Server		
OS/2		
Banyan Vines		
Unix		
MVS		
OS/400		
Java VM		
Other		

Please describe which server platform you will use to distribute applications and data to network computer devices: _____

_____

_____

_____

Additional comments on server platforms for network computer devices: _____

_____

_____

_____

How many of the servers that will be in the target environment 12-18 months from now are directly attributable to adding network computer devices to your organization? _____

_____

_____

Please indicate the mix (by percent) of "client to server" or "to the desktop" LAN technologies in the target environment, both installed today and planned for in the next 12-18 months. Please do not include server backbone technology or server-server connections.

LAN Technology	% Installed	% Planned in	% Directly Attributable to Network Computer Device Installation in the

	Today	12-18 months	Next 12-18 Months
Ethernet			
Switched Ethernet			
Fast Ethernet			
Switched Fast Ethernet			
Token Ring			
Switched Token Ring			
ATM			
Terminal-host (coax, etc.)			
Other _____			

Have there been or any changes (or planned changes) to the network infrastructure due to the introduction of network computer devices into the target environment? Please describe: _____

_____

_____

_____

Please describe the overall performance and availability of your campus network infrastructure. How frequently are there network "blackouts" (i.e., no network connectivity) or "brownouts" (i.e., sluggishness in performance)? Please describe: _____

_____

_____

_____

_____

Distributed Computing Infrastructure Information

The following series of questions focuses on the hardware, software, and services costs for the target environment.

Client Costs

The subsequent three tables ask about the *client* hardware and software costs. Please note network computer device costs are captured in a different section of the survey. Please place Windows-based PC client costs in the first table (Windows-Based PC Cost Components). If you are using Unix in your environment, then place Unix client costs in the second table (Unix Cost

Components). If you are using terminals in your organization, please put your terminal costs in the third table (Terminal Cost Components). The "Refresh Rate" is the frequency with which your organization replaces its hardware or software.

Windows-Based PC Cost Components	$ Amount	Refresh Rate
Average initial price of PC desktop client		
Average price of monitor		
Average hardware upgrade per PC, per year		**N/A**
Client OS cost		
Server OS license cost per PC		
Average cost of productivity or workgroup applications developed/purchased per PC (e.g., MS Office, mail, calendar)		
Average cost of business mission-critical applications developed/purchased per PC		
Utility software cost per PC (e.g., supplemental directory services, virus protection)		
Other		

Unix Cost Components	$ Amount	Refresh Rate
Average initial price of client		
Average price of monitor		
Average hardware upgrade per client, per year		**N/A**
Client OS cost		
Average cost of productivity or workgroup applications developed/purchased per client (e.g. MS Office, mail, calendar, etc.)		
Average cost of business mission critical applications developed/purchased per client		
Server OS license cost per client		
Utility software cost per client (e.g., supplemental directory services, virus protection)		
Other		

Terminal Cost Components	$ Amount	Refresh Rate
Average initial price of client		
Average price of monitor (if appropriate)		
Average hardware upgrade per client, per year		**N/A**
Server OS license cost per PC		
Other		

Network Costs

The following questions apply to "campus" or LAN *networking costs* for the target environment. Please do not include hardware or services associated with wide-area networks (WANs) or Internet access. The "Refresh Rate" is the frequency with which your organization replaces the hardware or software.

Network Cost Component	$ Amount	Refresh Rate
Aggregate cost for cable plant (e.g., wiring, network jacks, patch panels)		**N/A**
Aggregate cost for all network hubs (or front-end processors)		
Aggregate cost for campus routers and switches		
Other		

Please identify *any additional network components* that were or will be installed in your target environment specifically for the purpose of supporting additional Windows-based PC clients. Please give the component description along with the additional costs. Also indicate if *fewer* components are required.

Additional Network Cost Component for PCs Only	Description	$ Amount
Cable plant (e.g., wiring, network jacks, patch panels)		
Network hubs (or front-end processors)		
Routers and switches		
Other		

Please identify *any additional network components* that were or will be installed in your target environment specifically for the purpose of supporting the network computer devices. Please give the component description along with the additional costs. Also indicate if *fewer* components are required.

Additional Network Cost Component Due to Network Computer Devices	Description	$ Amount
Cable plant (e.g., wiring, network jacks, patch panels)		
Network hubs (or front-end processors)		
Routers and switches		
Other		

Server Costs

The following questions focus on *server* hardware, software, and services costs for the target environment. These costs are for the target environment's clients only: please *pro-rate* hardware and software if used outside of the target environment. The "Refresh Rate" is the frequency with which your organization replaces the hardware or software.

Server Cost Component	$ Amount	Refresh Rate
Aggregate cost for all login and file/print server hardware		
Aggregate cost for all application server hardware		
Aggregate cost for any other dedicated or specialized server hardware; please describe_____		
Aggregate cost for server or network operating system software		
Average hardware upgrade per year for all servers		**N/A**
Aggregate costs for server utilities (e.g., virus protection, backup software)		
Aggregate costs for other shared hardware resources (e.g., printers, scanners, fax servers)		

Please identify any additional *server components* that were or will be installed in your target environment to support the network computer devices. Please give the component description along with the additional costs. Also indicate if *fewer* components are required.

Additional Server Cost Component Due to Network Computer Devices	Description	$ Amount
Login and file/print server hardware		
Application (Java or ActiveX) server hardware		
Aggregate cost for any other dedicated or specialized server hardware; please describe_____		
Server or network operating system software		
Server utilities (e.g., virus protection, backup software)		
Additional hardware upgrades		
Other shared hardware resources (e.g., printers, scanners, fax servers)		

Management Infrastructure Costs

The following questions focuses on *management infrastructure* hardware and software costs for the target environment. Please include only those management solutions used exclusively for the target environment; if you include enterprise management solutions, please *pro-rate* the costs associated with the target environment.

The "Refresh Rate" is the frequency with which your organization replaces the hardware or software. The "% increase or decrease due to network computer devices" is your estimate of the cost percent increase or decrease due to the introduction of network computer devices during next 12 to 18 months.

Management Cost Component	$ Amount	Refresh Rate
Aggregate cost for network and systems management servers		
Aggregate cost for your management software solutions (e.g., Cabletron Spectrum, Tivoli TME, HP OpenView)		
Help desk server and software		
Aggregate cost for software distribution tools		
Network monitoring or sniffing equipment		
Other (please explain)		

Please identify any additional *management infrastructure components* that were or will be installed in your target environment to support the network computer devices. Please give the component description along with the additional costs. Also indicate if *fewer* components are required.

Additional Management Cost Component Due to Network Computer Devices	Description	$ Amount
Network and systems management servers		
Management software solutions (e.g., Cabletron Spectrum, Tivoli TME, HP OpenView)		
Help desk server and software		
Aggregate cost for software distribution tools		
Network monitoring or sniffing equipment		
Other (please explain)		

Operations Information

The following questions focus on the costs to operate, manage, and otherwise maintain the target computing environment. Generally, these costs are incurred through staff salary and overhead charges or "loads."

Management Staff Costs

These questions examine how many IT administrators or full-time equivalent (FTE) employees are dedicated to the management and administration of the target environment. MGC realizes that companies have varying approaches to organizing staff and managing a heterogeneous computing environment. We provide a number of tables to facilitate the accurate capture of these costs. Please try to estimate the "steady-state costs" for the data in the tables.

Please quantify the staff cost for the entire target environment in the first table (Management Cost Components for Heterogeneous Environments [excluding network computers]). If your organization has been able to quantify the staff costs for network computer devices independently, then please complete the second table (Management Cost Component Attributable to Network Computer Devices). A third table (Other Management Cost Component) is provided to capture Unix or terminal client management costs.

For MGC to calculate "fully burdened load" for each FTE, we need the following information in each of the three tables listed below. Please identify the total number of FTEs and then how many perform tasks within each specific management category. Also include the average salary for staff in each area and typical overhead or load factor. Lastly, if management staff members are used for Level 2/3 help desk, identify the amount of staff time spent on those support calls.

Management Cost Components for Heterogeneous Environment	FTEs	Average Salary & Load	% of Time Spent on Help Desk Tasks
Total number of management FTEs for all tasks performed at the organization			
Event/performance management			
Change and configuration management			
Job scheduling			
Security			
Storage management			
User/resource management			

Management Cost Component Attributable to Network Computer Devices	FTEs	Average Salary & Load	% of Time Spent on Help Desk Tasks
Total number of management FTEs for all tasks performed at the organization			
Asset/inventory management			
Change and configuration management			
Event/performance management			
Job scheduling			
Security			
Storage management			
User/resource management			

Other Management Cost Component Describe:_____	FTEs	Average Salary & Load	% of Time Spent on Help Desk Tasks
Total number of management FTEs for all tasks performed at the organization			
Asset/inventory management			
Change and configuration management			
Event/performance management			
Job scheduling			
Security			
Storage management			
User/resource management			

Please describe how frequently you distribute applications to users in your organization and the methods you use (e.g., electronic software distribution, manual loading of diskettes, etc.): _____

_____

_____

_____

Please quantify as best you can your operational or staff costs per client per year for software distribution (e.g., the cost for people and processes): _____

_____

_____

_____

Please estimate the total number of FTEs you need (or anticipate will be needed) to deploy all new and replacement desktop devices planned for in your organization in the next 12-18 months (excluding network computer devices): _____

_____

Please estimate the total number of FTEs you need (or anticipate will be needed) to deploy all new and replacement network computer devices planned for in your organization in the next 12-18 months: _____

_____

Support Costs

The following questions focus on support costs for end users within the target environment. Level 1 staff members receive requests (via phone or e-mail), generate trouble tickets with the help desk system, and answer frequently asked questions. Level 2 or 3 staff members solve any problems requiring a visit to the desktop, server room, or other location, which Level 1 staff can not and do not resolve. Please include the average salary for Level 1 and 2/3 staff and the typical overhead or load factor.

The first table captures costs for the entire heterogeneous environment. The second table examines costs just for the network computer devices.

Support Cost Component for Heterogeneous Environment	FTEs	Average Salary & Load
Number of Level 1 staff members		
Number of Level 2 or 3 staff members, if performed by a different group than management staff		

Support Cost Component for Network Computer Devices	FTEs	Average Salary & Load
Number of Level 1 staff members		
Number of Level 2 or 3 staff members, if performed by a different group than management staff		

Please indicate the number of calls to the help desk for all clients per month: _____

Please indicate the number of calls to the help desk for all network computer devices per month: _____

Training Costs

These questions focus on training costs for IT staff and end users in the target environment.

Training Cost Component	Current ($)	($) Projected for Next 12-18 Months	($) Projected for Adding Network Computer Devices in Next 12-18 Months
Aggregate training costs for users per year			
Aggregate training costs for IT staff per year			

What percent of the projected training costs for adding network computer devices in your training costs will be on-going steady state costs? _____

Network Computer Device Specific Information

The following set of questions pertain to the configuration and description of your network computer devices

Total number of network computer devices in the target environment today:
_____

Total number of network computer devices in the total organization today:
_____

Please describe the product vendor details of your installed or planned network computer devices.

Network Computer Device	Manufacturer or Name
Vendor/product name	
CPU type (e.g., Intel Pentium, SPARC)	
Name/type of network computer device operating system/monitor (if known)	

Please describe the factory-equipped and available options for your installed or planned network computer devices. Factory-equipped amount is for "standard" equipment on your network computer device. Available options are the maximum amount of RAM or expansion slots the device can accommodate.

Component	Factory-Equipped Amount	Available Option(s)
Total amount of RAM		
Expandable RAM		
Number of expansion slots		

Please indicate ("yes" or "no") which of the following features of your organization's network computer devices are shipped as standard equipment or as optional add-ons.

Component	Factory-Equipped (Yes or No)	Optional Feature (Yes or No)
Keyboard		
Monitor		
Network interface card		
Smartcard interface		
Built-in modem		
Optional modem		
Locked case		
Hard disk		
Floppy drive		
CD-ROM		
Other:		

Which of these best describes the role of network computer devices in your target environment? (Check all that apply.)

- ☐ Control client administration costs
- ☐ Internet access
- ☐ Intranet access
- ☐ Diskless PC replacement
- ☐ Windows-based PCs PC replacement
- ☐ Inventory access/processing
- ☐ Database access
- ☐ Replacement for dedicated application PCs
- ☐ Remote point-of-sale system
- ☐ 3270, 5250, or dumb terminal replacement
- ☐ X terminal replacement
- ☐ Multimedia desktop
- ☐ Other (please specify) _____

Which of the following BEST describes the configuration in which the network computer will be run? The term network in this question means accessing and utilizing applications and data resident on the server. (Select only one.)

- ☐ 100% network processing of applications and data
- ☐ 75% network/25% local processing of applications and data
- ☐ 50% network/50% local processing of applications and data
- ☐ 25% network/75% local processing of applications and data
- ☐ Less than 25% networked

Please check the answer that best applies to the following statement.

My company intends to primarily store and run our programs and data locally (on the client device) and to use the network only for automatic upgrade of the programs.

- ☐ Strongly agree
- ☐ Neither agree nor disagree
- ☐ Strongly disagree
- ☐ Don't know

Which of these best describes the type of applications that the network computer device will run or access (check all that apply)

- ☐ Internet/intranet/content access
- ☐ Word processing
- ☐ Spreadsheet processing
- ☐ Database access or updates
- ☐ Other office productivity
- ☐ E-mail, calendaring, scheduling
- ☐ Other groupware (e.g., discussion DB)
- ☐ Unix
- ☐ Java application/applet processing
- ☐ Transaction processing application
- ☐ Financial services
- ☐ Electronic commerce
- ☐ Healthcare
- ☐ Inventory control/management
- ☐ Order entry
- ☐ Pharmacy
- ☐ Multimedia
- ☐ Retail
- ☐ Remote point of sale
- ☐ Transportation
- ☐ Graphics/image processing

- ☐ Other network access (please specify): _____
- ☐ Other application processing (please specify): _____

Which of these best describes the *PRIMARY* application that the network computer device will access? (Choose only ONE response.)

- ☐ Internet/intranet/content access
- ☐ Word processing
- ☐ Spreadsheet processing
- ☐ Database access or updates
- ☐ Other office productivity
- ☐ E-mail, calendaring, scheduling
- ☐ Other groupware (e.g., discussion DB)
- ☐ Unix
- ☐ Java application/applet processing
- ☐ Transaction processing application
- ☐ Financial services
- ☐ Electronic commerce
- ☐ Healthcare
- ☐ Inventory control/management
- ☐ Order entry
- ☐ Pharmacy
- ☐ Multimedia
- ☐ Retail
- ☐ Remote point of sale
- ☐ Transportation
- ☐ Graphics/image processing
- ☐ Other network access (please specify): _____
- ☐ Other application processing (please specify): _____

Will the network computer device run or access applications that are considered "mission-critical" to the business? Please describe the application: _____

_____

_____

_____

_____

_____

What type of applications do you think the network computer device will be *unable to support* in your organization? (List all you can think of and describe why you think the network computer device won't be able to support them.)_____

How long do you anticipate having to support a dual network computer and Windows-based PC desktop environment in order to let an individual user access all the applications required to run your business? (This question implies that both devices will be used by the same person to access different types of applications.) Please check the appropriate box for the target environment and for the entire organization.

Length of Time Will Need to Support Both Network Computer and Windows-Based PC Devices for an Individual User	For Target Environment	For Entire Organization
Expect to support combined network computer and PC environments for less than 12 months		
Expect to support combined network computer and PC environments for 1 to 2 years		
Expect to support combined network computer and PC environments for 3 to 5 years		
Expect to support mixed client environment for more than 5 years		
Don't know		
Other:		

Long term (i.e., 3-5 years out) and within the target environment, what percentage of clients do you plan or project to be network computer devices?

- ☐ 100%
- ☐ 75%-99%
- ☐ 51%-75%
- ☐ 26%-50%
- ☐ 11%-25%
- ☐ 0%-10%

How long do you plan on taking to deploy network computer devices in the target environment?

- ☐ 0-6 months
- ☐ 6-12 months
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ Other: _____

How long do you plan on taking to deploy network computer devices across the entire organization?

- ☐ 0-6 months
- ☐ 6-12 months
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ Other: _____

Financial and Business Drivers/Benefits

Briefly describe the original business case or the primary business drivers in your decision to move to an network computer solution and the benefits you expected to achieve.

_____
_____
_____
_____

Briefly describe your organization's primary objectives in implementing a network computer solution.

_____
_____
_____
_____

What were your organization's original cost projections or total budget for installing network computer devices?_____

_____

Which of the following statements best describes the results you achieved regarding your organization's network computer budget goals? (Check only one.)

- ☐ Exceeded budget expectations
- ☐ Met budget expectations
- ☐ Under budget
- ☐ Haven't determined results yet

What were your organization's original cost projections or total budget for purchasing or developing applications to support the network computer device? _____

Which of the following statements best describes the results you achieved regarding your organization's network computer application purchase or development budget goals? (Check only one.)

- ☐ Exceeded budget expectations
- ☐ Met budget expectations
- ☐ Under budget
- ☐ Haven't determined results yet

What is the budget earmarked for the development of network computer applications in:

1997?_____

1998?_____

Please describe the type of applications that your organization will be developing that specifically take advantage of the network computer devices: _____

_____

_____

_____

_____

Has your application development organization realized (or is it expected to realize) cost savings using Internet and Web-based technologies (e.g., Java, ActiveX) and Web paradigms (e.g., applets, push/pull technology, browser-based access to content)? Please describe: _____

Please describe any additional cost *advantages* your organization will derive from the development and/or deployment of network computer specific applications: _____

Please describe any additional cost *disadvantages* your organization will derive from the development and/or deployment of network computer specific applications: _____

Do you anticipate any differences in your application support costs after network computer devices are installed in your organization? Please describe: _____

Would you expect application support costs to be similar or different for the PCs in your organization? Please describe: _____

Do you anticipate any differences in your application distribution costs after network computer devices are installed in your organization? Please describe: _____

_____

_____

_____

_____

Would you expect application distribution costs to be similar or different for the PCs in your organization? Please describe:

_____

_____

_____

_____

Do you anticipate any differences in your application maintenance costs after network computer devices are installed in your organization? Please describe: _____

_____

_____

_____

_____

Would you expect application maintenance costs to be similar or different for the PCs in your organization? Please describe: _____

_____

_____

Are there existing financial analyses underway that focus on network computer devices? Please describe: _____

_____

_____

_____